Biological Assessment for USDA Forest Service
Fish Passage Restoration Activities
Affecting ESA-listed Animal and Plant Species found in eastern Oregon and the whole of Washington

Prepared by:

Region 6 United States Forest Service

In Partnership with

US Fish and Wildlife Service
and
NOAA Fisheries

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US Fish and Wildlife Service
and
NOAA Fisheries

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I. Introduction

A. Background

To more aggressively address dwindling salmon, trout, and other fish stocks, all National Forest Land and Resource Management Plans in Oregon and Washington were amended in the early 1990's to better protect fish habitat. These amendments are commonly known as the Northwest Forest Plan (NWFP) (USDA and USDI 1994), INFISH (USDA and USDI 1995a), and PACFISH (USDA and USDI 1995b). A common element in each plan is an aquatic conservation strategy (ACS), providing a framework for the protection and restoration of fish stocks and water quality. The Region 6 Forest Service (FS) believes that the ACS has and will continue to serve as a major cornerstone of Pacific Northwest (PNW) fish recovery efforts into the foreseeable future. The ACS is comprised of four basic elements, those being riparian reserves, key watersheds, watershed analysis, and watershed restoration:

- *Riparian Reserves* (NWFP) or Riparian Habitat Conservation Areas (INFISH and PACFISH) are those portions of National Forest system lands where riparian dependent resources receive primary emphasis. Riparian reserves include those places in the watershed directly coupled to streams and rivers, the areas required for maintaining hydrologic, geomorphic, and ecological processes that directly affect standing and flowing water bodies such as lakes, ponds, wetlands, streams, stream processes and fish habitats (USDA and USDI 1994). These riparian habitats help maintain the integrity of the aquatic ecosystems by (1) influencing the delivery of coarse sediment, organic matter, and woody debris to streams (2) providing root strength for channel stability (3) shading the stream, and (4) protecting water quality (USDA and USDI 1995a). To maintain the integrity of riparian reserves, which vary from 50 to 300 feet on either side of a water body, all management activities in these areas are guided by standards and guides, which prohibit or regulate activities that retard or prevent the attainment of riparian functions. Many of these riparian reserves gain added significance with inclusion in Key Watersheds.

- *Key or Priority Watersheds* are a network of watersheds that serve as refuges for salmon and other fish species, many of which are listed under the Endangered Species Act (ESA). Watersheds in good condition serve as anchors for the potential recovery of depressed fish stocks, while watersheds characterized by having low quality habitat and high potential for restoration can serve as future refuge areas (USDA and USDI 1994). Under INFISH, priority watersheds were designated, in part, to protect watersheds with excellent habitat, especially for bull trout and metapopulation objectives (USDA and USDI 1995a).

- *Watershed Analysis* is a means to diagnose the health of a watershed, especially key watersheds, and documents the root causes of habitat degradation and those ecosystem processes that create quality habitat through time. Since 1994, approximately 300 watershed analyses have been completed by Oregon and Washington National Forests, all of which identify factors limiting fish production and associated restoration actions.

- *Watershed Restoration* is a program, based on watershed analysis, that helps restore a watershed's hydrological and ecological processes that are necessary to ensuring the long-term recovery of fish populations and water quality. The FS watershed restoration program emphasizes key watersheds and is holistic, whereby projects cover uplands (i.e. conifer thinning, controlled burning, and road decommissioning), riparian areas (i.e. conifer or hardwood thinning), and in-channel projects (i.e. large wood, boulders, channel reconstruction, and fish passage restoration at road crossings).

To further elevate the ACS as a cornerstone to fish recovery in the PNW, the Region 6 FS embarked on a proactive program to reconnect fragmented fish habitats by restoring fish passage at road crossings within and amongst watersheds, especially key and priority watersheds, throughout Oregon and Washington. A fish passage restoration program will help coalesce ACS elements, literally connecting riparian reserves, key watersheds, and restored habitats that have been disconnected through impassable culverts. This restoration activity will better fulfill NWFP, PACFISH, and INFISH standards and guidelines, which state that FS administrative units must "Provide and maintain fish passage at all road crossings of existing and potential fish-bearing streams." An ACS objective specific to the NWFP states that FS administered lands will be managed to "Maintain and restore spatial and temporal connectivity within and between watersheds...These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian dependent species" (USDA and USDI 1994). The fulfillment of these objectives are consistent with fish recovery goals described in the US Fish and Wildlife Service (FWS) draft bull trout recovery strategy and NOAA Fisheries suggested restoration activities to restore anadromous fish stocks (Roni et al. 2002). Finally, the barrier removal and habitat connectivity program not only complements the FWS and NOAA Fisheries recovery efforts, it is consistent with Oregon (HB 3002 - 2001) and Washington (RCW 77.55.060) fish passage statutes, both mandating fish passage at obstructions across streams.

From 2000 through 2002, the Region 6 FS took the first step in implementing a fish barrier removal program and inventoried approximately 80% of its culverts at road crossings on fish-bearing streams. To date, across the 18 National Forests and one Scenic Area in Oregon and Washington, approximately 4,000 culverts have been assessed, using a standardized protocol that documented or measured the following variables: culvert type, length, width, and height, culvert slope, channel alignment, pool depth at culvert outlet, jumping height to culvert outlet, and channel gradient. Of the measured culverts, about 80% pass adult salmon, 50% pass adult resident fish, and 20% pass juvenile fish.

To better equip FS personnel with addressing the next step of replacing culverts for fish passage, the Region 6 FS created a curriculum to elevate the technical skills required to plan, design, install, and monitor culvert replacements. The new training sessions, entitled "Restoration of Aquatic-Species Passage Using Stream Simulation," emphasize the ways in which culvert replacements should be designed to accommodate natural hydrological and ecological processes. Four sessions have been offered, two through the Oregon

Technology Center and two via the Washington Technology Transfer Center. Representatives from federal, state, and county agencies have attended, with 50 participants being Region 6 FS employees. Instructors included recognized professionals from Federal and State natural resource agencies, Universities, and consulting firms. Even more, the FS has taken an additional step to ensure high quality-control standards by creating Master Performer Teams. These Region 6 FS interdisciplinary teams—comprised of a fish biologist, hydrologist, and an engineer—review culvert designs for Oregon and Washington Forests. Team members represent some of the top performers in aquatic restoration and engineering in the Region 6 FS.

Finally, to create even more efficiencies in replacing culverts for fish passage, the Region 6 FS has worked with regulatory agencies to streamline permit processes for culvert installations. Such efforts with Oregon and Washington state agencies responsible for Clean Water Act removal and fill laws have resulted in exemptions for certain culverts installations that provide for fish passage. These compliment a similar exemption offered by the US Army Corps of Engineers, Portland District.

B. Programmatic Objective

A recent General Accounting Office audit entitled "Land Management Agencies: Restoring fish passage through culverts on Forest Service and BLM lands in Oregon and Washington could take decades," identified that the often lengthy Section 7 consultation process is one of several barriers that impedes efficient implementation of a fish passage restoration program (GAO 2001). To address this issue, the FS, FWS, and the NOAA Fisheries have developed a process that will streamline Section 7 consultation for fish passage restoration projects, helping to eliminate the current dominance of project level consultations. This BA depicts an approach to describe and evaluate the effects of four programmatic fish passage restoration activity categories:

- Culvert/Road-Fill Removal and Channel Restoration
- Culvert Replacement with a Stream Simulation Culvert or Open-Bottomed Arch
- Culvert Replacement with a Stream Simulation Bridge
- Maintenance of Programmatic Fish Passage Projects

This BA covers the above projects that occur within the range of listed species under the ESA of 1973 as amended and current critical habitat. Further, this BA covers issues related to the Magnuson-Stevens Fishery Conservation and Management Act (MSA) as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267) establishing essential fish habitat across Oregon and Washington.

This programmatic approach provides each FS administrative unit with a consistent methodology and appropriate criteria for implementing, documenting, evaluating, and monitoring fish passage restoration activities. All proposed activity categories comply with the Record of Decision and Standards and Guidelines of the NWFP (USDA and USDI 1994), PACFISH (USDA and USDI 1995b), and INFISH (USDA and USDI 1995a), and respective National Forest Land and Resource Management Plans. In addition, this approach facilitates ESA Section 7 and MSA consultation with FWS and NOAA Fisheries and provides information of sufficient detail and quality to support the appropriate FWS and NOAA Fisheries analysis.

C. Species That May Be Affected

1. **Fish Species**
   This assessment evaluates and describes potential effects on the following ESA-listed fish species regulated by NOAA Fisheries: Lower Columbia River Chinook Salmon, Upper Columbia River Spring-Run Chinook Salmon, Puget Sound Chinook Salmon, Snake River Fall-Run Chinook Salmon, Snake River Spring/Summer-Run Chinook Salmon, Columbia River Chum Salmon, Hood Canal Summer-Run Chum Salmon, Lower Columbia River Steelhead, Middle Columbia Steelhead, Upper Columbia River Steelhead, Snake River Basin Steelhead. Further, this assessment evaluates and describes potential effects on the following ESA-listed fish species regulated by the FWS: Bull Trout, Shortnose Sucker, Lost River Sucker, and Warner Sucker.
2. **Wildlife Species**
   Next, this assessment evaluates and describes potential effects on the following ESA-listed bird and mammal species regulated by the FWS: Bald Eagle, Marbled Murrelet, Northern Spotted Owl, Canada Lynx, Gray Wolf, Grizzly Bear, and Woodland Caribou.
3. **Plant Species**
   Finally, this assessment evaluates and describes potential effects on the following ESA-listed plant species regulated by the FWS: Howells's Spectacular Thelypody, MacFarlane's Four-O'clock, Marsh Sandwort, Showy Stickweed, Spalding's Catchfly, Ute Ladies'-Tresses, Water Howellia, and Wenatchee Mountains Checker-Mallow.

D. Geographic Scope of BA

For the purpose of this BA, the programmatic consultation covers that portion of Oregon east of the Cascade Mountains' crest and the whole of Washington, wherever FS administrative units are found. Those portions of the Mt. Hood National Forest, which occur east of the Cascade Mountains' crest, and the Crooked River National Grasslands are excluded. Further, projects that occur on non-federal lands are included when a culvert removal or replacement leads to the passage of fish onto FS administered lands. To be included, such non-federal land projects must follow all elements of the proposed action outlined in Chapter II. Those FS administrative units not included in this BA are currently covered by FWS and/or NOAA Fisheries Programmatic Biological Opinions for culvert replacement projects or do not have ESA-listed species needing coverage. Table 1 displays each FS unit, where proposed activities may occur, and the associated ESA-listed fish, wildlife, and plant species that may be affected. Further, Figures 1 -3 display the geographic scope of the BA and the ESA-listed fish species that occur within a FS administrative unit and associated sub-basins.

E. Implementation of the Programmatic Consultation

As fish passage restoration actions are proposed, the responsible Interdisciplinary Team will analyze those actions to determine if they fit under one of the activity categories covered in this BA and meet the design criteria and terms and conditions of subsequent BO's—one each from the FWS and NOAA Fisheries. This information will be documented in project files, explaining how each project tiers to this BA and subsequent BO's. If the effect determination is the same as the programmatic effect determination or less (e.g., programmatic effect determination is LAA and individual action is LAA or NLAA) and the design criteria conform to those within the BA/BO, no additional consultation is necessary. If the effect determination is greater than the programmatic effects determination or the design criteria do not conform to those within the BA/BO, a separate consultation will be required.

For the northern spotted owl and marbled murrelet, an estimated number of acres that may be affected by harassment related to project activities have been provided in this BA. The number of acres affected, by species, should be documented for each project. If the number of acres identified for a Forest is exceeded (either the annual maximum or the total estimated over the 5-year period covered by this BA), then consultation will need to be reinitiated.

Each action agency may also choose to initiate consultation if an individual project is of unusually large scale or highly complex or controversial, even if it would otherwise fit within one of the covered programmatic categories. Separate consultations will be required for all "may affect" projects that do not fit within programmatic categories.

Table 1 - Forest Service Units and Affected ESA-Listed Species		
Forest Service Units	**State**	**Affected Species**
Colville NF	WA	**Fish** - Bull Trout **Wildlife** – Northern Bald Eagle, Canada Lynx, Gray Wolf, Grizzly Bear, and Woodland Caribou
Columbia River Gorge Scenic Area	OR/WA	**Fish –** Bull Trout, Lower Columbia River Chinook Salmon, Lower Columbia River Chum Salmon, Lower Columbia River Steelhead, Middle Columbia River Steelhead **Wildlife** – Northern Bald Eagle, Northern Spotted Owl (including Critical Habitat) **Plants -** Water Howellia
Deschutes	OR	**Fish –** Bull Trout **Wildlife –** Northern Bald Eagle, Northern Spotted Owl (including Critical Habitat), Canada Lynx
Fremont/Winema	OR	**Fish –** Bull Trout, Lost River Sucker, Shortnose Sucker, Warner Sucker **Wildlife –** Northern Bald Eagle, Northern Spotted Owl (including Critical Habitat)
Gifford Pinchot	WA	**Fish –** Bull Trout, Lower Columbia River Chinook Salmon, Lower Columbia River Steelhead, Middle Columbia River Steelhead **Wildlife –** Northern Bald Eagle, Marbled Murrelet (including Critical Habitat), Northern Spotted Owl (including Critical Habitat), Gray Wolf, Grizzly Bear, Canada Lynx **Plants –** Water Howellia
Malheur	OR	**Fish –** Bull Trout, Middle Columbia River Steelhead **Wildlife –**Northern Bald Eagle, Canada Lynx, Gray Wolf
Mt. Baker-Snoqualmie	WA	**Fish –** Bull Trout, Puget Sound Chinook Salmon **Wildlife –** Northern Bald Eagle, Marbled Murrelet (including Critical Habitat), Northern Spotted Owl (including Critical Habitat), Canada Lynx, Gray Wolf, Grizzly Bear
Ochoco	OR	**Fish -** Bull Trout, Middle Columbia River Steelhead **Wildlife –** Northern Bald Eagle, Canada Lynx
Okanogan/Wenatchee	WA	**Fish –** Bull Trout, Upper Columbia River Spring-Run Chinook Salmon, Middle Columbia River Steelhead, Upper Columbia River Steelhead **Wildlife –**Northern Bald Eagle, Northern Spotted Owl (including Critical Habitat), Canada Lynx, Gray Wolf, Grizzly Bear **Plants –** Showy Stickseed, Ute Ladies'-tresses, Water Howellia, Wenatchee Mountains Checker-Mallow
Olympic	WA	**Fish -** Bull Trout, Puget Sound Chinook Salmon, Hood River Canal Summer-Run Chum Salmon **Wildlife –** Northern Bald Eagle, Marbled Murrelet (including Critical Habitat), Northern Spotted Owl (including Critical Habitat), **Plants** – Marsh Sandwort
Umatilla	OR/WA	**Fish –** Bull Trout, Snake River Spring Summer-Run Chinook Salmon, Middle Columbia River Steelhead, Snake River Basin Steelhead **Wildlife –** Northern Bald Eagle, Canada Lynx, Gray Wolf **Plants –** Spalding's Catchfly
Wallowa-Whitman	OR	**Fish –** Bull Trout, Snake River Fall Chinook, Snake River spring/summer Chinook, Middle Columbia Steelhead, Snake River Steelhead **Wildlife –** Northern Bald Eagle, Gray Wolf, Canada Lynx **Plants -** Howell's Spectacular Thelypody, MacFarlane's Four-O'Clock, Spalding's Catchfly, Ute Ladies'-Tresses, and Water Howellia

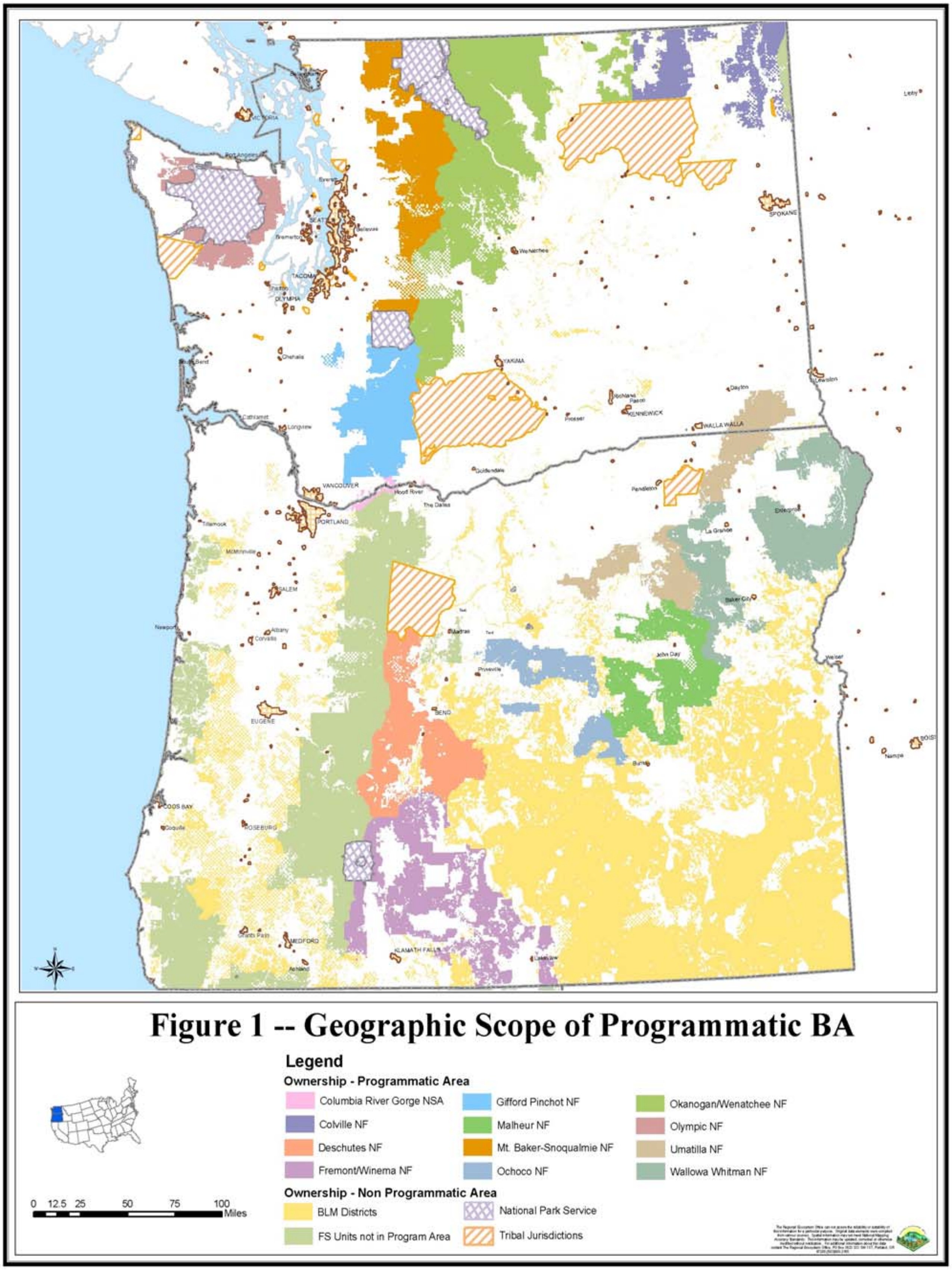


Figure 1 -- Geographic Scope of Programmatic BA

Figure 2
FS Administrative Units, Sub-basins and ESA-Listed Fish In Programmatic Area - Washington

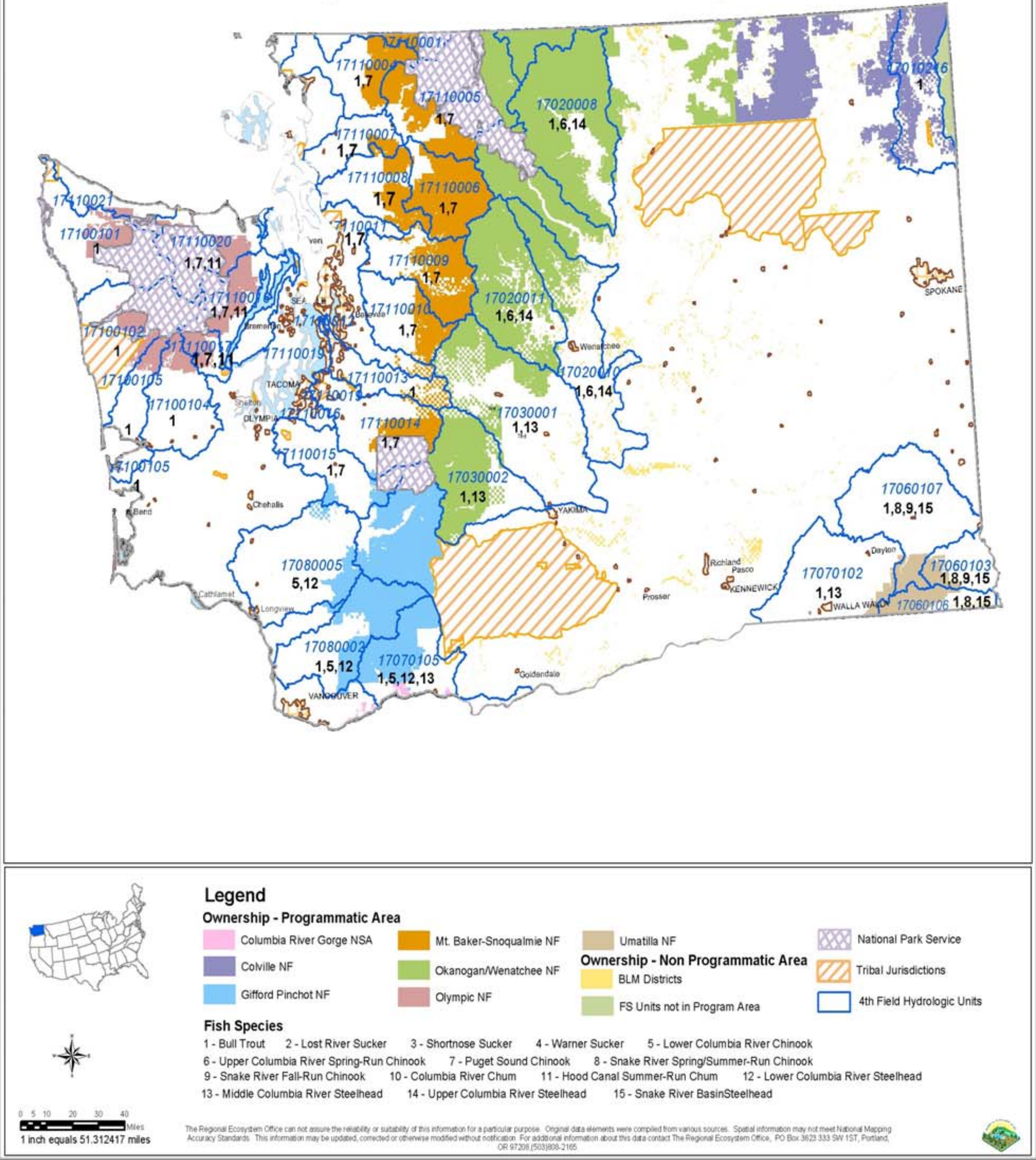
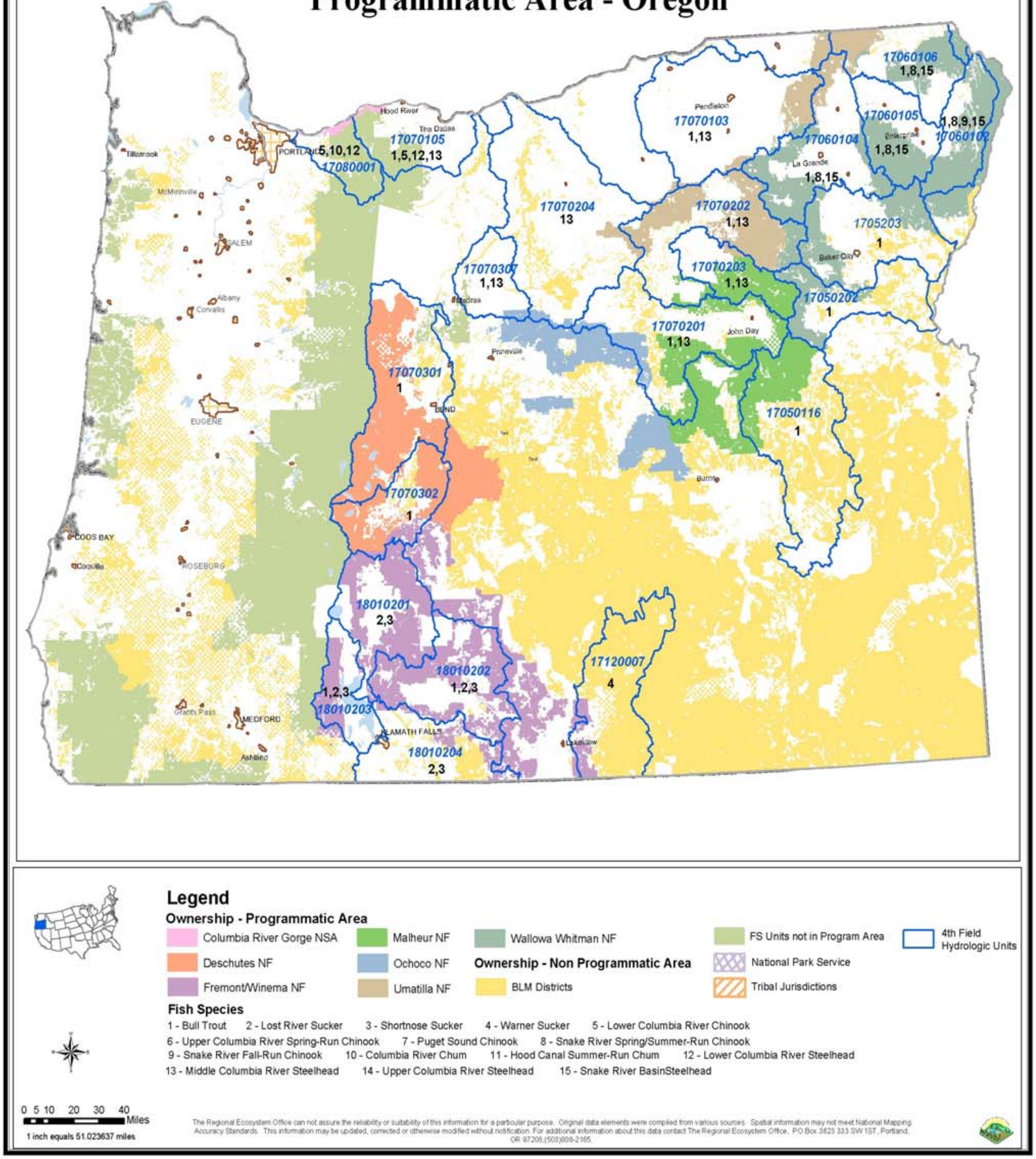


Figure 3
FS Administrative Units, Sub-basins and ESA-Listed Fish In Programmatic Area - Oregon



II. Description of the Programmatic Actions

A. FS Fish Passage Goals and Number of Projects Proposed

1. **Fish Passage Goals**
   The intent of this BA is to help streamline efforts that lead towards the attainment of Region 6 FS fish passage goals. First, the NWFP, PACFISH, and INFISH standards and guides all state that FS administrative units must "Provide and maintain fish passage at all road crossings of existing and potential fish-bearing streams." In addition, such road crossings should be constructed or improved in a manner that accommodates 100-year floods and associated bedload and debris. Region 6 FS policy—file code 7700/2600 and dated August 29, 2002—provides guidance as to the ways in which fish passage culverts at road crossings should be constructed and include the following design standards:
   - Meet or exceed state requirements and guidance for fish passage.
   - Provide passage for all fish species and life stages present at that location.
   - Culvert width should not constrict the stream at 2-year high flow (bankfull width).
   - The natural stream gradient and substrate material, above and below the structure, will be simulated through the structure.
2. **Number of Proposed Projects**
   The aforementioned fish passage goals will be applied to the 120-culvert removal and replacement projects that can be implemented under this BA on an annual basis. With 12 FS units covered under this BA, this results in a distribution of 10 projects per FS unit each year. Individual FS units, however, can implement more than 10 projects per year, as long as the overall total for all units does not exceed 120. Regarding the distribution of projects on an individual FS unit, no more than five projects per year can be implemented within a 5th HUC. In addition, for a culvert to be eligible for removal or replacement under this BA, it must be part of the Region 6 FS culvert database. The database can be revised on an annual basis to reflect new culvert surveys and potential projects. For a culvert to be eligible during a calendar year, it must be part of the database by December 15 of the previous year.

B. Programmatic Activity Categories

The following four actions are the types of culvert treatments that will be covered by this programmatic BA:

1. **Culvert/Road-Fill Removal and Channel Restoration**
   When a Fish Passage Interdisciplinary Team determines that culvert removal is the best alternative, impassible culverts will be removed and the affected area will be restored to a more natural state. (Section "E" of this chapter describes the composition and general duties of a Fish Passage Interdisciplinary Team.) Following culvert removal, the channel will be reconstructed to mimic natural bankfull width and active floodplain dimensions which exist up and downstream of the project area. This activity will occur to restore physical and biological connectivity, most notable passage for ESA-listed fish. Finally, culvert removal projects will occur in association with a closed/decommissioned road and not low-water fords.

2. **Culvert Replacement with a Stream Simulation Culvert or Open-Bottomed Arch**
   When a Fish Passage Interdisciplinary Team determines that a culvert replacement is the best alternative, impassible culverts will be removed and replaced with one of the following stream simulation structures: culvert or open-bottomed arch. (Culvert refers to the variety of closed-bottomed metal and concrete structures.) Culvert and open-bottomed arch widths will be at least bankfull width. Flood relief culverts on floodplains associated with Rosgen C, E, and B stream types may be used. This activity will occur to restore physical and biological connectivity, most notable passage for ESA-listed fish. Such replacements will occur when the associated road is required for National Forest transportation needs and 100-year flows and associated debris can be accommodated by a culvert or open-bottomed arch.
3. **Culvert Replacement with a Stream Simulation Bridge**
   When a Fish Passage Interdisciplinary Team determines that replacement by a bridge is the best alternative, impassible culverts will be removed and replaced with a stream simulation bridge. Bridge footings will be placed beyond bankfull width with possible flood relief culverts or additional spans associated with Rosgen C, E, and B stream types. This activity type will occur to restore physical and biological connectivity, most notable passage for ESA-listed fish. Bridges are likely to be the preferred road crossing structure when the associated road is required for National Forest transportation needs and expected 100-year flows and associated debris are too large for culvert/open-bottomed arch projects or when these project costs approximate those of bridge construction.
4. **Maintenance of Programmatic Fish Passage Projects**
   Maintenance activities will be directed at the aforementioned culvert replacement activity categories designed and constructed under this BA. Maintenance actions include removal of debris that have accumulated at the culvert, open-bottomed arch, or bridge inlet during flood events and have been determined to obstruct fish passage or pose threats to the integrity of the road crossing. Woody debris removed from the road-crossing inlet would be placed within the immediate vicinity downstream of the road crossing.

C. Programmatic Culvert and Bridge Design Parameters

1. **Design Parameters**
   Any new design shall include the following structure and stream channel parameters:

   a. **Stream Simulation –** Stream simulation designs are intended to mimic the natural stream processes at a road/stream crossing within a culvert, opened-bottom arch, or under a bridge. Fish passage, sediment transport, flood and debris conveyance within the structure are intended to imitate the stream conditions up and downstream of the crossing as close to natural conditions as the structure type allows. Structures that accomplish this design are culverts (closed-bottomed structures), open-bottomed arches, and bridges. Culverts will be partially filled with material that simulates the natural streambed. Finally, stream simulation requires a high level of information regarding stream hydrology/geomorphology and engineering.

i. **Culvert Width -** The width (at stream elevation) of culverts, opened-bottom arches, and between bridge footings shall be equal to, or greater than, the bankfull channel width. (Structure widths on National Forests within the state of Washington must be at least bankfull width x 1.2 + 2'.) The minimum structure width shall be 6 feet to allow placement of stream simulation material. For channel types with developed floodplains (e.g. Rosgen channel types C, E, B), the structure must accommodate a 100-year flood flow without significant change in substrate size and composition. To meet this requirement, C, E, and B channel types require structures wider than bankfull or flood relief culverts. When possible, flood relief culverts will be designed to restore and maintain access to off-channel rearing and high flow refuge areas for juvenile and adult fish. Therefore, existing floodplain channels should be the first priority for location of flood relief culverts and installed in a manner that match floodplain gradient and does not lead to scour at the outlet.

ii. **Channel Slope –** The structure slope shall approximate the average slope of the natural stream from approximately 20 times the stream width upstream and 20 times the stream width downstream of the site (or to the nearest grade control) in which it is being placed. The maximum slope for closed-bottomed culverts shall not exceed 6% because of difficulties in retaining substrate in the culvert at higher gradients. Open-bottomed arches can be placed in channel gradients that exceed 6%.

iii. **Embedment –** If a culvert is used, the bottom of the culvert shall be buried into the streambed not less than 30% and not more than 50% of the culvert height. For open-bottomed arches and bridges, the footings or foundation shall be designed to be stable at the largest anticipated scour depth.

iv. **Bridges -** Maximum individual span length shall not exceed 135'; no piers, abutments, or exposed riprap within bankfull width.

Refer to Figure 4 - *Cross Section Diagrams of Culvert Removal and Replacements*. The diagrams provide a general view of road crossings before and after construction. Actual structures may show variations in design and shape.

Figure 4 – Cross Section Diagrams of Culvert Removal and Replacements

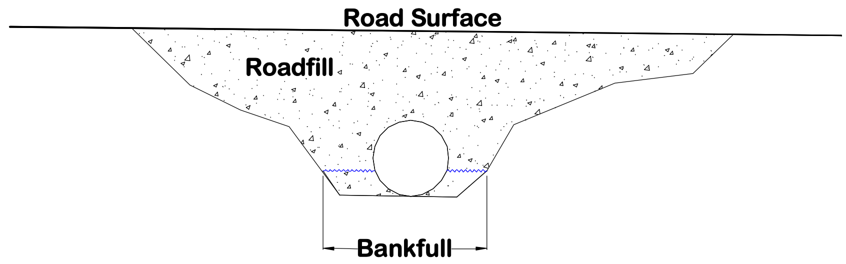
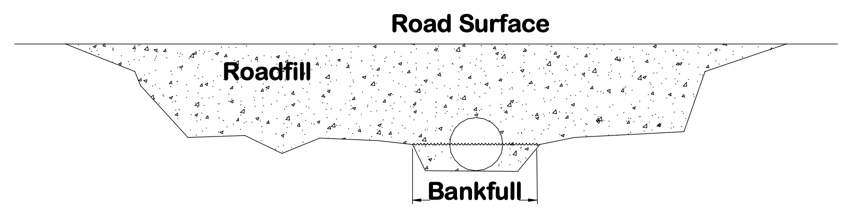
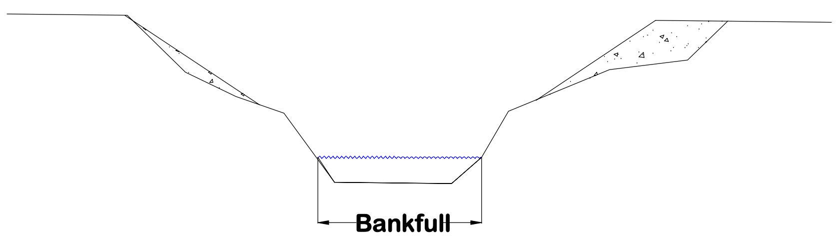
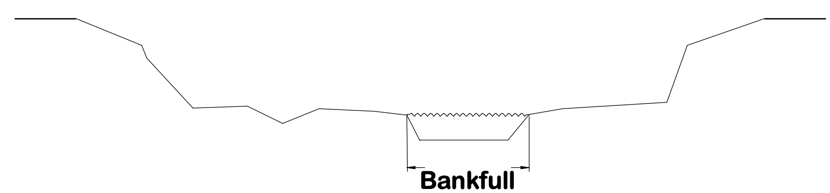
Design Type	Constrained Floodplain (Rosgen A, F, G channels)	Unconstrained Floodplains (Rosgen B, C, E channels)
Before Barrier Removal		
After Barrier Removal **Channel Restor-ation**		

Figure 4 – Cross Section Diagrams of Culvert Removal and Replacements

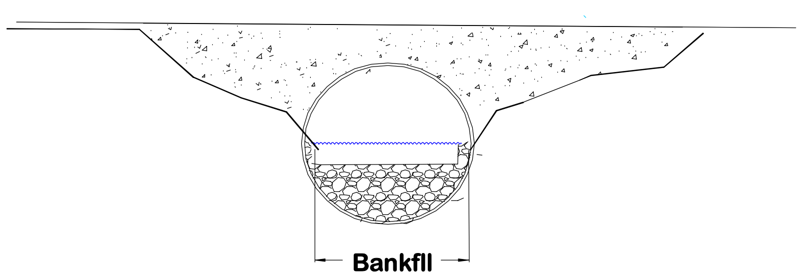
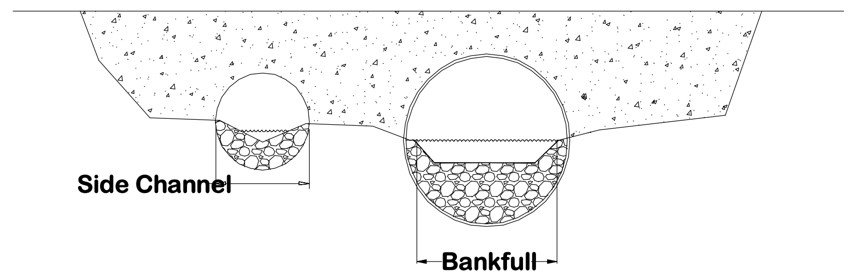
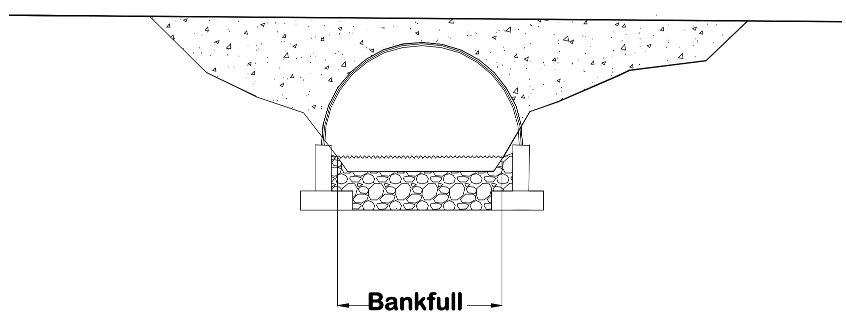
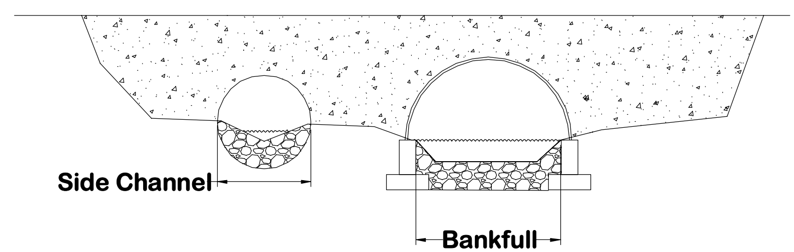
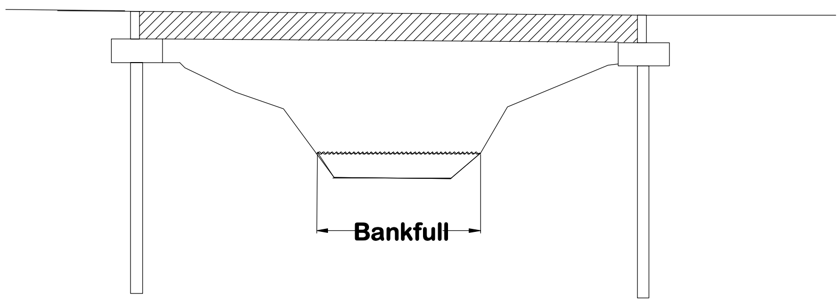
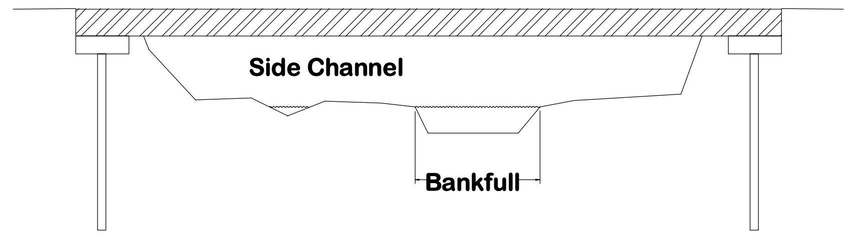
Design Type	Constrained Floodplain (Rosgen A, F, G channels)	Unconstrained Floodplains (Rosgen B, C, E channels)
After Barrier Removal Bankfull Culvert		
After Barrier Removal Bankfull Open-Bottomed Arch		

Figure 4 – Cross Section Diagrams of Culvert Removal and Replacements

Design Type	Constrained Floodplain (Rosgen A, F, G channels)	Unconstrained Floodplains (Rosgen B, C, E channels)
After Barrier Removal Bridge		

D. Excluded Projects

The following FS actions will not be covered by the programmatic BA.

Table 2 – Excluded Projects and Associated Justifications	
Excluded Projects	**Justification**
1. Projects that lead to headcutting below the natural stream gradient	Upstream headcutting degrades stream channels and may create an upstream passage barrier.
2. Projects that permit exotic fish into isolated bull trout populations	Exotic fish, such as brown or brook trout, may compete and hybridize with bull trout.
3. Culvert widths less than bankfull width	Culverts less than bankfull width would not meet Region 6 guidelines and stream simulation goals.
4. Culvert widths < 6 feet	Culverts less than 6 feet in width inhibit manual or mechanical placement of substrate within the structure.
5. Embedded culverts at a slope greater than 6%	Substrate within closed-bottomed culverts is prone to washout at gradients greater than 6%.
6. Baffled culverts	Baffled culverts do not meet Region 6 guidelines and stream simulation goals.
7. Culvert Retrofitting	Culvert retrofitting does not meet Region 6 guidelines and stream simulation goals.
8. Active Channel and Hydraulic Design methods	These methods do not meet Region 6 guidelines and stream simulation goals.
9. Individual bridge spans >135’	Cost and design complexity
10. Projects not within in-water work window	Work during this time may lead to adverse effects not assessed under this BA.
11. Culvert locations not in Region 6 culvert database	Precludes access to site-specific information for FWS analysis. Database updates to be made prior to December 15 of each year.
12. No more than 5 projects within a 5th field HUC per year	To avoid adverse effects to fish and/or habitat.

E. Fish Passage Interdisciplinary Team (IDT)

This section describes the IDT and the process it uses to determine the appropriate design for actions covered under this BA.

1. **Purpose and Composition**
   Because the design of stream simulation projects requires not only engineering skills but those related to hydrology/fluvial geomorphology and fisheries biology, the IDT will be comprised of at least FS qualified engineer, hydrologist (or geomorphologist), and fisheries biologist. Involvement of individual team members will vary throughout the planning process, depending on information required during a particular planning phase. The following paragraphs provide guidelines for the ways in which Forest or District IDT's should function throughout planning and design processes.
2. **Identification of Culvert Barriers for Treatment**
   First, the IDT determines whether or not an existing culvert is a barrier to fish passage as identified in the Region 6 culvert database. Culverts listed in the database were assessed by field crews that documented the following: culvert type, length, width, and height, culvert slope, channel alignment, pool depth at culvert outlet, jumping height to culvert outlet, and channel gradient.
3. **Prioritization of Road Crossing Treatments**
   This section provides suggestions for the ways in which an IDT can prioritize culverts for removal or replacement.
   a. **Watershed Prioritization –** Considerations for determining which watersheds culvert removal or replacements are of highest priority may include the following: number of fish species within a watershed, quality and quantity of habitat, a watershed's restoration potential, Regional and/or Forest priorities, status as a key or priority watershed associated with the NWFP, PACFISH, or INFISH.
   b. **Project Prioritization –** Within the chosen watershed/s, an IDT may consider the following to determine priority culverts to be removed or replaced: watershed assessments, transportation analysis, quantity and quality of habitat upstream of the barrier, number of fish species affected, presence of exotic fish species, risk of headcutting, culvert condition, funding restrictions, NEPA status, and more.
   c. **Implementation Prioritization –** If more than one project will occur on a stream during the same in-water work period, consider implementing the upper most projects first then moving downstream to the next.
   d. **Bull Trout Prioritization** – For culvert removal or replacement projects intended to benefit bull trout, the FWS suggests that IDT's consider the following factors in order of priority:
      i. In cases of small populations where survival is the utmost concern due to limited access to quality habitat, replace culverts to restore access to upstream habitat, eliminate concentration of fish at culvert outlets where fishing can reduce numbers, and to prevent catastrophic impacts from road crossing failure.
      ii. In more secure populations, replace culverts to restore connectivity within local populations where numbers are low, restore connectivity between populations, restore connectivity within local populations where numbers are not low.
      iii. Where bull trout do not currently reside, prioritize culvert projects that restore connectivity between critical habitat units first, then culvert projects within recovery units.

4. **Initial Field Review**
   As an initial step to the design process, the IDT will conduct a general field review of the site, identifying biological and physical characteristics to help guide the design process. The field review will incorporate the following:
   a. **Current Conditions** - Assess current stream conditions, existing stream crossing, fish species above and below the road crossing, and other landscape modifications that may impair natural stream processes and functions.
   b. **Desired Condition (Restoration Potential)** – Conduct a basic assessment to identify natural habitat conditions and stream geomorphology, using field identifiers, stream reference reaches, and historic records if readily available. These conditions correspond to those attributes that support ESA-listed fish residing in the project vicinity.
   c. **Proposed Conditions -** Identify target conditions—and differences between current and desired conditions—that can be reasonably achieved through programmatic activity categories and other restoration projects.

   The information obtained from a field review will help the IDT develop a project that provides the greatest benefit for fish passage, movement of sediment and large wood, and goals for additional stream restoration efforts.
5. **Site Characteristics**
   The IDT oversees the collection of project-site data essential for the design of a stream simulation structure.
   a. **Site Plan** – Information is gathered to create a site plan that depicts the locations of the culvert, staging area, stockpile area, temporary access roads, stream crossings, etc.
   b. **Measurement of Existing Site Features** – Dimensions of the affected structures—culvert, road, road fill, utilities, etc—are documented.
   c. **Watershed Features –** Information gathered under this category relates to the potential for landslides, debris torrents, etc. within or upstream of the project location.
   d. **Fluvial Geomorphologic Features –** Stream channel and floodplain features are measured—including bankfull width (cross sections), floodplain dimensions, stream gradient (longitudinal profile), sinuosity, and channel substrate—all of which are required to create a stream simulation structure. Assess the 100-year flow potential and the channel's vertical stability. Bankfull stage indicators, used to identify bankfull width, can include a break in slope of banks and/or a change in particle size distribution, staining on rocks, changes in vegetation types, elevation associated with the top of the highest depositional features (point bars or central bars in the active channel).
   e. **Headcutting –** Assess the sites potential for headcutting below the natural stream gradient using the following document as a guide: Castro, J. 2003. Geomorphologic Impacts of Culvert Replacement and Removal: Avoiding Channel Incision. USFWS, Portland, OR.
   f. **Site Geometry –** Survey to document site geometry, which results in a site-specific topographic map, depicting elevations of the stream channel, floodplain, culvert, road, and other relevant features.
6. **Fish Passage Design Review Process**

Forest Engineers will review all stream simulation designs submitted by an IDT. Further, Master Performer Teams will provide additional reviews for all larger and more complex projects (culverts, open-bottomed arches, and bridges with more than a 20' span or costing more than $100,000 or when requested). During FY2003, for instance, the Master Performer Teams will review approximately 70% of the projects, a general indicator as to the level of involvement by Master Performer Teams in future years.

7. **IDT Relationship to Level I Teams**
The appropriate FS unit will notify a Level I Team of a proposed action to be covered under this programmatic through the NEPA scoping process, conveying that the proposed action meets conditions outlined in the BA and subsequent BO. Because Section 7 consultation requirements will be met through this BA and subsequent BO, additional involvement of Level I Teams with IDT's is not required.

8. **Project Documentation**
To track those steps in the IDT process, which are essential to meet stream simulation goals, project documentation should contain at least the following: width and slope of impassable culvert, fish species (and life history stages) above and below impassable culvert, bankfull width and slope of stream channel, designation of channel substrate, proposed structure type, width and slope of proposed structure, risk of headcutting. This information is needed for monitoring and reporting requirements found under section "I. Annual Monitoring and Reporting Requirements" of this chapter. Further, this documentation can be useful during the review and project implementation process to ensure the follow-through of an intended design for a culvert, open-bottomed arch, or bridge.

F. Fish Passage Construction Methods, Impacts, and Related Conservation Measures

This section describes each construction phase required to complete the four programmatic activity categories described in part "B" of this chapter. Construction phase descriptions include methods and impacts followed by a list of conservation measures, which are intended to minimize impacts and associated effects to aquatic life and water quality. For the purpose of this BA, the word "impact" refers to the physical alteration—type and scope—of the action area, those areas affected directly or indirectly by construction. In general, combined impacts, resulting from all phases of construction, will result in approximately one to three cubic-yards of fine sediments introduced into the stream channel during project implementation. In rare instances, up to five cubic-yards of sediment may be introduced into the stream channel and will likely occur on projects with large fill slopes and/or structures.

The amounts of project-introduced sediments are expected to be minimal if not insignificant relative to annual watershed sediment budgets. Langbein and Schumm (1958) found that annual sediment production varied from a maximum of about 800 tons per square mile in areas that received about 15 inches of precipitation per year and declined to about 300 tons per square mile per year in areas with 40- 60 inches of rain per year. In the Bull Run watershed, which provides drinking water to the city of Portland, Oregon, the sediment budget for this relatively intact watershed was estimated to be 79 cubic yards per square mile per year (Carlson 2003) or 119 tons per year. Consequently, the programmatic related sediment introduced into a stream channel appears insignificant relative to the annual sediment budget of an associated watershed. For instance, a 10,000-acre watershed in western Washington might produce 4,688 tons per year (based on 300 tons per square mile). One cubic yard of sediment would weigh 1.5 tons, three cubic yards would weigh 4.5 tons, and five cubic yards would weigh about 7.5 tons, producing amounts equal to 1/3,125th , 1/1,041th , and 1/625th the annual sediment budget for that watershed, respectively. Further, this project related sediment would equate to a one-time occurrence.

To meet the FS goal of minimizing introduction of sediment into the stream channel, the following construction phases and methods will be implemented and represent typical actions required for implementation of programmatic activities. Based on site-specific conditions, construction methods or phases may vary as to more effectively meet the goals of stream simulation and minimizing erosion into the stream.

1. **Equipment Used**
   Equipment used for all culvert removal and replacement projects would typically consist of a mix of the following: back hoe, bulldozer, tractor, grader, dump truck, front-end loader, excavator, crane, concrete pumper truck, paving machine, pile driver, pumps, helicopters, explosives, hydraulic hammers, hydroseeding truck, large and small compactors, hand shovels, and rakes. It is anticipated that helicopters and/or explosives will be used on approximately 10% of the projects and is likely to be less.
2. **Site Preparation**
   This construction phase applies to the following categories: Culvert/Road-Fill Removal and Channel Restoration, Culvert Replacement with a Stream Simulation Culvert or Open-Bottomed Arch, Culvert Replacement with a Stream Simulation Bridge, and Maintenance.
   a. **Construction Methods** – The commencement of the project includes the following actions: Flag boundaries of staging areas, stockpile areas, and other locations where impacts are expected. If sufficient staging or stockpile areas do not exist, areas of sufficient size may be cleared and grubbed. Place material, which may be excavated during this time, in the stockpile area. Store machinery, equipment, and materials in the staging area. Where needed, place sediment barriers or silt fences around impacted areas to prevent erosion into the stream channel and road ditches.
   b. **Construction Impacts –** If staging and stockpile areas are cleared, topsoil will be exposed to potential erosion. Newly cleared areas should be less than one acre.
   c. **Conservation Measures –** Employ the following Conservation Measure to minimize construction impacts: #3. Pollution and Erosion Control Plan (PECP) and Supporting Measures, subsections c. Minimize Site Preparation Impacts; d. Minimize Heavy Equipment Fuel/Oil Leakage; e. Minimize Earthmoving Related Erosion. Refer to part "G. Conservation Measures for Fish Species and Habitats" within this chapter. For measures that minimize and avoid effects to bird, mammal, and plant species, refer to part "H. Conservation Measures for Terrestrial Species and Habitats" of this chapter.
3. **Excavate Road Fill Above Wetted Perimeter**

This construction phase applies to the following categories: Culvert/Road-Fill Removal and Channel Restoration, Culvert Replacement with a Stream Simulation Culvert or Open-Bottomed Arch, Culvert Replacement with a Stream Simulation Bridge.

a. **Construction Methods** - Excavate road fill around culvert to just above wetted perimeter. Excavating equipment would typically work from the road fill, and excavated material would be stored at a nearby stockpile site subject to erosion control measures or to a permanent waste area if new material is to be brought in for backfilling. Excavation to the wetted perimeter is necessary for dewatering procedures. For culvert removal projects, remove road fill within the active floodplain and haul to a permanent waste area. Machinery may cross streams at designated crossings.
b. **Construction Impacts** – The road fill material around the culvert will be exposed to potential erosion along with the road prism associated with culvert removals. Stream channel substrate will be disturbed if machinery crosses a stream. Therefore, aggregate construction impacts will likely include the staging and stockpile areas, road fill around the culvert, designated stream crossings, and possibly the road prism crossing the flood plain.
c. **Conservation Measures -** Employ the following Conservation Measure to minimize construction impacts: #1. In-Water Work Windows, #3. PECP and Supporting Measures, subsections a. Follow State Water Quality Guidelines; b. Spill Prevention and Containment Plan (SPCCP); d. Minimize Heavy Equipment Fuel/Oil Leakage; e. Minimize Earthmoving Related Erosion; f. Minimize Stream Crossing Sedimentation. Refer to part "G. Conservation Measures for Fish Species and Habitats" within this chapter. For measures that minimize and avoid effects to bird, mammal, and plant species, refer to part "H. Conservation Measures for Terrestrial Species and Habitats" of this chapter.

4. Isolate Construction from Stream Flow

Isolate construction sites from stream flow before removing a culvert and performing work inside the stream channel. This construction phase applies to the following categories: Culvert/Road-Fill Removal and Channel Restoration, Culvert Replacement with a Stream Simulation Culvert or Open-Bottomed Arch, Culvert Replacement with a Stream Simulation Bridge.

a. **Construction Methods**
   i. **Dewater Construction Site -** Prior to constructing a water diversion at the project site, place block nets to isolate the construction activity area. Remove as many aquatic organisms as possible from the stream area isolated with block nets using the least obtrusive methods possible. Maintain the block nets during the construction of the dewatering structure.

      The dewatering structure is typically a temporary dam built just upstream of the project site with sand bags that are filled with clean gravel and covered with plastic sheeting. A portable bladder dam or other non-erosive diversion technologies may be used to contain stream flow; however, mining of stream or floodplain rock cannot be used for diversion dam construction. In most cases, a pipe will carry the stream flow from the diversion dam around the project site to a location immediately downstream of the construction zone. The length of the dewatered stream channel will vary, depending on the width of the road prism at the stream crossing. It may be necessary to have temporary equipment access through the riparian area to the site of the dewatering structure. Fish may be allowed to move downstream through the diversion when it is determined that entrapment will not occur.

Dewatering will be accomplished slowly with a crew on hand to capture and move aquatic organisms that appear as the water level drops at the construction site. Standard fish handling procedures will be used to minimize stress to the captured aquatic organisms. Captured aquatic organisms will usually be released upstream from the project area in suitable habitat.

ii. **Reroute Stream Flow within Existing Channel –** Stream flow will be rerouted to one side of the existing channel with diversion structures, such as sandbags, portable bladders, or other non-erosive diversion technologies used to contain stream flow; however, the use of stream or floodplain rock and sediment cannot be used for diversion dam construction. The conditions in which in-channel rerouting can occur are when the stream channel is wide enough to accommodate rerouting and the diversion path—including a pipe or one side of the existing channel—is essentially non-erosive. When used, this method would typically be associated with the construction of open-bottomed arches and bridges. Under this scenario, fish can pass freely up or downstream; if a pipe is used, however, only downstream movement may be permissible.

b. **Construction Impacts**

i. **Dewater Construction Site -** Fish may be captured and transported into the channel upstream of the project site. The access road to the stream's edge will impact a narrow cross section of riparian area, removing vegetation and exposing bare soil to erosion. The stream channel between the diversion inlet and outlet will be dewatered, and the diversion structure may act as a barrier to fish passage. The length of stream being dewatered will vary, depending on the width of the road prism at the stream crossing. Therefore, aggregate construction impacts include the exposed staging and stockpile areas, road fill at the stream crossing, dewatered stream channel, designated stream crossings, and possibly the road prism crossing the flood plain.

ii. **Reroute Stream Flow within Existing Channel –** The stream flow between the diversion inlet and outlet will be rerouted to one side of the existing channel. Fish may be captured and transported into the channel upstream of the project site. The length of stream reroute will vary, depending on the width of the road prism at the stream crossing. Therefore, aggregate construction impacts include the exposed staging and stockpile areas, road fill at the stream crossing, dewatered stream channel, designated stream crossings, and possibly the road prism crossing the flood plain.

c. **Conservation Measures for Dewater Construction Site and Reroute Streamflow within Existing Channel –** Employ the following Conservation Measure to minimize construction impacts: #1. In-Water Work Windows, #2. Fish Handling and Transfer Protocols, and #3. PECP and Supporting Measures, subsections a. Follow State Water Quality Guidelines; b SPCCP; d. Minimize Heavy Equipment Fuel/Oil Leakage; e. Minimize Earthmoving Related Erosion; f. Minimize Stream Crossing Sedimentation; g. Minimize Sedimentation through Dewatering. Refer to part "G. Conservation Measures for Fish Species and Habitats" within this chapter. For measures that minimize and avoid effects to bird, mammal, and plant species, refer to part "H. Conservation Measures for Terrestrial Species and Habitats" of this chapter.

5. **Remove Impassible Culvert and Excavate Channel Substrate**
   This construction phase applies to the following categories: Culvert/Road-Fill Removal and Channel Restoration, Culvert Replacement with a Stream Simulation Culvert or Open-Bottomed Arch, Culvert Replacement with a Stream Simulation Bridge.
   a. **Construction Actions -** Remove existing road fill and store fill at a nearby stockpile site or haul to a permanent waste area (if being replaced). At this point, the culvert will be removed followed by excavation of the remaining material down to bottom of construction elevations and wide enough to accommodate a bankfull culvert, open-bottom arch, or bridge footings. Excavating equipment would typically work from the road fill and cross the stream within the dewatered area or at a designated stream crossing. During excavation, excess groundwater would be removed from the work area by pumping to a treatment area prior to discharge back into any water body.
   b. **Construction Impacts –** The stream channel and road fill down to the construction elevation will be exposed to potential erosion. Therefore, aggregate construction impacts will likely include the exposed staging and stockpile areas, road fill at the stream crossing, dewatered stream channel, designated stream crossings, and possibly the road prism crossing the flood plain.
   c. **Conservation Measures –** Employ the following Conservation Measure to minimize construction impacts: #1. In-Water Work Windows and #3. PECP and Supporting Measures, subsections a. Follow State Water Quality Guidelines; b SPCCP; d. Minimize Heavy Equipment Fuel/Oil Leakage; e. Minimize Earthmoving Related Erosion; f. Minimize Stream Crossing Sedimentation; g. Minimize Sedimentation through Dewatering. Refer to part "G. Conservation Measures for Fish Species and Habitats" within this chapter. For measures that minimize and avoid effects to bird, mammal, and plant species, refer to part "H. Conservation Measures for Terrestrial Species and Habitats" of this chapter.

6. **Construct Fish Passage Structure, Replace Backfill, and Embed Structure**
   This construction phase applies to the following categories: Culvert/Road-Fill Removal and Channel Restoration, Culvert Replacement with a Stream Simulation Culvert or Open-Bottomed Arch, Culvert Replacement with a Stream Simulation Bridge.
   a. **Construction Methods**
      i. **Culvert Removal** – Reconstruct the stream channel cross-section and gradient within the area formerly occupied by the culvert in a manner that mimics more natural conditions found up and downstream. Further, reconstruct the floodplain to mimic floodplain elevations and dimensions that occur up and downstream of the project site. Large wood and/or boulders may be placed in the reconstructed stream channel and floodplain.

ii. **Culvert Placement and Backfill**– Place and shape culvert-bedding material, assemble and place culvert in position, then place fill around it in successive layers to begin the restoration of the road prism. Place embankment fill to at least ½ of the culvert height before placing substrate within the culvert. (The backfill may be placed to an elevation as to construct the road prism, and if so headwalls may be constructed at this time.) Machinery placing the culvert would typically work from the road fill and cross the stream within dewatered area or at a designated stream crossing. When necessary, install flood relief culverts for Rosgen B, C, and E stream types. Concrete maybe poured to provide bedding for squashed culverts. To embed the culvert with substrate, haul infill material from an offsite location or use suitable material from a project stockpile. Place properly sized substrate and compact in lifts inside culvert to the required height.

iii. **Open-Bottom Arch Placement and Backfill –** Likely construction methods would include placement of footing forms, pouring and curing of concrete, followed by the assembly of the arch and its attachment to the concrete footings. Fill would then be placed in thin lifts or layers around the structure to begin restoration of the road prism. (The backfill maybe placed to an elevation as to construct the road prism, and if so headwalls may be constructed at this time.) Construction machinery would typically operate from the road fill and cross the stream within the dewatered area or at a designated stream crossing. When necessary, install flood relief culverts for Rosgen B, C, and E stream types. To embed the open-bottomed arch with substrate, haul infill material from an offsite location or use suitable material from a project stockpile. Place the properly sized substrate and compact in thin lifts to the required height within the footings.

iv. **Bridge Placement–** One of following three construction methods will likely be used and in each case will occur outside bankfull width: 1) Construct pile abutments by driving piles below stream channel then forming and pouring concrete cap. 2) Build concrete footings or piers below stream channel through excavation and placement of forms followed by pouring and curing of concrete. 3) Place pre-cast or cast in place footings and compacted fill protected by rip rap slopes outside the bankfull width. Headwalls may be constructed to protect the road fill prism. Fill would be placed where necessary to help restore the road prism. Machinery would typically work from the road fill and cross the stream within dewatered area or at a designated stream crossing. Other construction actions will likely include the following: placement of substrate material and fill-slope riprap, beams, grout seam, build deck, form curbs, place guardrails and approach rails, and paving. Further, reconstruct the stream channel cross-section and gradient within the area formerly occupied by the culvert in a manner that reflects more natural conditions found up and downstream. Haul excavated material offsite. Large wood and/or boulders maybe placed in the reconstructed stream channel and floodplain. If necessary, install flood relief culverts for Rosgen B, C, and E stream types.

b. **Construction Impacts –** All construction for each of the road activities will occur in areas already impacted by earlier construction phases. In cases where flood relief culverts or additional bridge spans are required, isolated segments of the road prism within the floodplain will be disturbed. Therefore, aggregate construction impacts include the exposed staging and stockpile areas, road fill at the stream crossing, dewatered stream channel, designated stream crossing, and possibly the road prism crossing the flood plain.

c. **Conservation Measures –** Employ the following Conservation Measure to minimize construction impacts: #1. In-Water Work Windows and #3. PECP and Supporting Measures, subsections a. Follow State Water Quality Guidelines; b SPCCP; d. Minimize Heavy Equipment Fuel/Oil Leakage; e. Minimize Earthmoving Related Erosion; f. Minimize Stream Crossing Sedimentation; g. Minimize Sedimentation through Dewatering. Refer to part "G. Conservation Measures for Fish Species and Habitats" within this chapter. For measures that minimize and avoid effects to bird, mammal, and plant species, refer to part "H. Conservation Measures for Terrestrial Species and Habitats" of this chapter.

7. **Remove Stream Diversion and Restore Stream Flow**

This construction phase applies to the following categories: Culvert/Road-Fill Removal and Channel Restoration, Culvert Replacement with a Stream Simulation Culvert or Open-Bottomed Arch, Culvert Replacement with a Stream Simulation Bridge

a. **Construction Actions –** Remove diversion dam and water routing equipment. Heavy machinery—operating from the bank or within the channel—may be used to aid in removal of diversion structures. Re-watering the construction site occurs at such a rate as to prevent loss of surface water downstream as the construction site streambed absorbs water. If needed for fish passage, excavate a channel through sediment wedges immediately upstream of the road crossing.

b. **Construction Impacts -** Stream channel substrate will be minimally disturbed with the removal of the diversion dam. Restored stream flow will flush out substrate fines within the formerly dewatered area, resulting in increased but short-lived stream turbidity (usually less than 2 hours). Therefore, aggregate construction impacts now include the exposed staging and stockpile areas, road fill at the stream crossing, the formerly dewatered stream channel, designated stream crossing, and possibly the road prism crossing the flood plain.

c. **Conservation Measures –** Employ the following Conservation Measure to minimize construction impacts: #1. In-Water Work Windows and #3. PECP and Supporting Measures, subsections a. Follow State Water Quality Guidelines; b SPCCP; d. Minimize Heavy Equipment Fuel/Oil Leakage; e. Minimize Earthmoving Related Erosion; f. Minimize Stream Crossing Sedimentation; h. Flow Reintroduction. Refer to part "G. Conservation Measures for Fish Species and Habitats" within this chapter. For measures that minimize and avoid effects to bird, mammal, and plant species, refer to part "H. Conservation Measures for Terrestrial Species and Habitats" of this chapter.

8. **Backfill to Road Surface**

This construction phase applies to the following categories: Culvert Replacement with a Stream Simulation Culvert or Open-Bottomed Arch, and Culvert Replacement with a Stream Simulation Bridge

a. **Construction Methods –** Headwalls may be constructed at this time. Place and compact fill in thin lifts over the culvert or open-bottomed arch to top of subgrade.

Haul in backfill material from stockpiling or outside sources. Construct road surface.

b. **Construction Impacts –** All construction activities for each of the road crossing structures will occur in areas already impacted by earlier construction phases. Most, if not all, work will occur on the road prism.

c. **Conservation Measures** – Employ the following Conservation Measure to minimize construction impacts: #1. In-Water Work Windows (when necessary) and #3. PECP and Supporting Measures, subsections a. Follow State Water Quality Guidelines; b SPCCP; d. Minimize Heavy Equipment Fuel/Oil Leakage; e. Minimize Earthmoving Related Erosion; f. Minimize Stream Crossing Sedimentation. Refer to part "G. Conservation Measures for Fish Species and Habitats" within this chapter. For measures that minimize and avoid effects to bird, mammal, and plant species, refer to part "H. Conservation Measures for Terrestrial Species and Habitats" of this chapter.

9. Site Restoration

This construction phase applies to the following categories: Culvert/Road-Fill Removal and Channel Restoration, Culvert Replacement with a Stream Simulation Culvert or Open-Bottomed Arch, Culvert Replacement with a Stream Simulation Bridge, and Maintenance.

a. **Construction Methods –** Place road fill erosion protection measures, such as boulder-sized riprap, planting, erosion control fabric, seed, and mulch. Scatter and place stockpiled woody debris. Remove equipment and excess supplies, clean work storage areas, and remove temporary erosion control materials. If required to prevent erosion, seed and/or plant embankment and other impacted areas.

b. **Construction Impacts –** All actions are intended to be restorative in nature and will be confined to areas impacted throughout the project.

c. **Conservation Measures -** Employ the following Conservation Measures to minimize construction impacts: #1. In-Water Work Windows (when necessary); #3. Pollution and Erosion Measures, subsections a. Meet State Water Quality Guidelines; b. Pollution and Erosion Control Plan (PECP); c. Minimize Heavy Equipment Fuel/Oil Leakage; d. Minimize Stream Crossing Sedimentation; e. Minimize Earthmoving Related Erosion; j. Site Restoration. Refer to part "G. Conservation Measures for Fish Species and Habitats" within this chapter. For measures that minimize and avoid effects to bird, mammal, and plant species, refer to part "H. Conservation Measures for Terrestrial Species and Habitats" of this chapter.

10. Maintenance

This construction phase applies to the programmatic activity category referred to as "Maintenance of Programmatic Fish Passage Projects" and is associated with culvert replacement projects implemented under this BA.

a. **Construction Methods –**Large wood that has accumulated at the inlet of a culvert, open-bottomed arch, or bridge will be removed and placed immediately downstream of the outlet. When access permits, large wood will be placed within the bankfull channel. Machinery used to remove and place large wood will operate from the road prism, a temporary access to the stream channel, or within the stream channel. In most cases, maintenance activities will usually be completed in two days or less.

b. **Construction Impacts –** A staging and stockpile area may be cleared and grubbed, and access may be required to the stream channel. Further, stream channel substrate will be disturbed if machinery crosses a stream. Therefore, aggregate construction impacts will likely include the staging and stockpile areas, and designated stream crossings.

c. **Conservation Measures –** Employ the following Conservation Measure to minimize construction impacts: #1. In-Water Work Windows and #3. PECP and Supporting Measures, subsections a. Follow State Water Quality Guidelines; b SPCCP; c. Minimize Site Preparation Impacts; d. Minimize Heavy Equipment Fuel/Oil Leakage; e. Minimize Earthmoving Related Erosion; f. Minimize Stream Crossing Sedimentation; j. Site Restoration. Refer to part "G. Conservation Measures for Fish Species and Habitats" within this chapter. For measures that minimize and avoid effects to bird, mammal, and plant species, refer to part "H. Conservation Measures for Terrestrial Species and Habitats" of this chapter.

11. Post Project (Streambed Reconstruction)

With culvert replacements implemented under this BA, it is anticipated that substrate degradation within a culvert or open-bottomed arch and/or scour at the outlet will occur on less than 10% of the projects. Under these circumstances, remedial actions will be taken to restore substrate within the structure and/or scour pool. Such actions will occur only when the substrate size originally placed within the structure and scour pool was determined to be undersized and not because the size or gradient of culvert were inappropriate**.**

a. **Construction Methods –** Methods will be similar to those found in the following Construction Methods described above: #2. Site Preparation; #4 Isolate Construction from Stream; #6 Construct Fish Passage Structure, Replace Backfill, and Embed Structure (this will be limited to the "Embed Structure" portion); #7 - Remove Stream Diversion and Restore Stream Flow; and #10 Site Restoration.

b. **Construction Impacts –** Impacts that are likely to occur include those associated with following Construction Methods described above: #2. Site Preparation; #4 Isolate Construction from Stream; #6 Construct Fish Passage Structure, Replace Backfill, and Embed Structure (this will be limited to the "Embed Structure" portion); #7 - Remove Stream Diversion and Restore Stream Flow; and #10 Site Restoration.

c. **Conservation Measures –** Employ the following Conservation Measure to minimize construction impacts: #1. In-Water Work Windows, #2. Fish Handling and Transfer Protocols, and #3. PECP and Supporting Measures, subsections a. Follow State Water Quality Guidelines; b SPCCP; c. Minimize Site Preparation Impacts; d. Minimize Heavy Equipment Fuel/Oil Leakage; e. Minimize Earthmoving Related Erosion; f. Minimize Stream Crossing Sedimentation; g. Minimize Sedimentation through Dewatering; h. Flow Reintroduction; j. Site Restoration. Refer to part "G. Conservation Measures for Fish Species and Habitats" within this chapter. For measures that minimize and avoid effects to bird, mammal, and plant species, refer to part "H. Conservation Measures for Terrestrial Species and Habitats" of this chapter.

G. Conservation Measures for Fish Species and Habitats

1. **In-Water Work Windows**
   Follow appropriate state—Oregon and Washington—guidelines for timing of in-water work periods for the relevant ESA-listed fish species. Refer to Appendix 1 for Oregon and Washington in-water work window guidelines.
2. **Fish Handling and Transfer Protocols**
   If capture, removal, and relocation of ESA-listed fish are required, follow these steps:
   a. **Isolate Work Area** – Install block nets at up and downstream locations and leave in a secured position to exclude fish from entering the project area. Leave nets secured to the stream channel bed and banks until fish capture and transport activities are complete. If block nets remain in place more than one day, monitor the nets on a daily basis to ensure they are secured to the banks and free of organic accumulation.
   b. **Fish Capture Alternatives**
      i. Collect fish by hand or dip nets, as the area is slowly dewatered.
      i. Seining – Use seine with mesh of such a size to ensure entrapment of the residing ESA-listed fish.
      ii. Minnow traps – Traps will be left in place overnight and in conjunction with seining.
      iii. Electrofishing – Prior to dewatering, use electrofishing only where other means of fish capture may not be feasible or effective. The protocol for electrofishing includes the following:
         a. If fish are observed spawning during the in-water work period, electrofishing shall not contact spawning adult fish or active redds.
         b. Only Direct Current (DC) or Pulsed Direct Current (PDC) shall be used.
         c. Conductivity <100 use voltage ranges from 900 to 1100. Conductivity from 100 to 300 then use voltage ranges from 500 to 800. Conductivity greater than 300 then use voltage to 400.
         d. Begin electrofishing with minimum pulse width then gradually increase to the point where fish are immobilized and captured.
         e. Do not allow fish to come into contact with anode. Do not electrofish an area for an extended period of time. Remove fish immediately from water.
         f. Dark bands on the fish indicate injury, suggesting a reduction in voltage and longer recovery time.
   c. **Storage and Release** – ESA-listed fish must be handled with extreme care and kept in water the maximum extent possible during transfer procedures. A healthy environment for the stressed fish shall be provided—large buckets (five-gallon minimum to prevent overcrowding) and minimal handling of fish. Place large fish in buckets separate from smaller prey-sized fish. Monitor water temperature in buckets and well-being of captured fish. After fish have recovered, release fish upstream of the isolated reach in a pool or area that provides cover and flow refuge. Document all fish injuries or mortalities and include in annual report. Refer to "I. Annual Monitoring and Reporting Requirements" in this chapter.

3. **Pollution and Erosion Control Plan (PECP) and Supporting Measures**
   Develop a PECP for each authorized project, one that includes methods and measures to minimize erosion and sedimentation associated with the project. The PECP elements shall be in place prior to and at all times during the appropriate construction phases. The following conservation measures will assist in the creation of a PECP.
   a. **Follow State Water Quality Guidelines** - All project actions will follow all provisions of the Clean Water Act and provisions for maintenance of water quality standards as described by Oregon Department of Environmental Quality (Oregon National Forests) and Washington Department of Ecology (Washington National Forests).
   b. **Spill Prevention Control and Containment Plan (SPCCP) –** The contractor will be required to have a written SPCCP, which describes measures to prevent or reduce impacts from potential spills (fuel, hydraulic fluid, etc). The SPCCP shall contain a description of the hazardous materials that will be used, including inventory, storage, handling, and monitoring.
   c. **Minimize Site Preparation Related Impacts** – Site preparation will be completed in the following manner:
      i. Flag boundaries of clearing limits associated with site access, riparian crossings, stream crossings, staging and stockpile areas to minimize overall disturbance and disturbance to critical vegetation.
      ii. Establish staging areas (used for construction equipment storage, vehicle storage, fueling, servicing, etc) along existing roadways or turnouts beyond the 100-year floodprone area in a location and manner that will preclude erosion into or contamination of the stream or floodplain.
      iii. Minimize clearing and grubbing activities, if required for preparation of staging or stockpile areas. Stockpile large wood, trees, riparian vegetation, other vegetation, sand, and topsoil removed for establishment of staging area for site restoration.
      iv. Place sediment barriers around disturbed sites where potential erosion may enter the stream directly or through road ditches, which are connected to the stream.
   d. **Minimize Heavy Equipment Fuel/Oil leakage** – Methods to minimize fuel/oil leakage from construction equipment into the stream channel and floodplain include the following:
      ii. All equipment used for instream work shall be cleaned and leaks repaired prior to arriving at the project. Remove external oil and grease, along with dirt and mud. Inspect all equipment before unloading at site. Thereafter, inspect equipment daily for leaks or accumulations of grease, and fix any identified problems before entering streams or areas that drain directly to streams or wetlands.
      iii. Equipment used for in-stream or riparian work shall be fueled and serviced in an established staging area. When not in use, vehicles will be stored in the staging area.
      iv. Two oil absorbing floating booms appropriate for the size of the stream shall be available on-site during all phases of construction whenever surface water is

present. Place booms in a location that facilitates an immediate response to potential petroleum leakage.

e. **Minimize Earthmoving Related Erosion** – Methods to minimize sedimentation resulting from earthmoving construction activities include the following:
   i. Minimize amounts of construction debris and soil falling into streams by installing appropriate erosion control barriers prior to construction. Such barriers should be maintained throughout the related construction and removed only when construction is complete. When possible, remove debris or large earth spills that have fallen into the channel.
   ii. In-stream blasting is not covered by this programmatic; however in-stream rock splitting by chemical expansion rock splitting or shot-shell powered rock splitting is permitted.
   iii. Delineate construction impact areas on project plans and confine work to the noted area. Confine construction impacts to the minimum area necessary to complete the project.
   iv. Keep a supply of erosion control materials (e.g., silt fence and straw bales) on hand to respond to sediment emergencies. Use sterile straw or "weed free" certified straw bales to prevent introduction of noxious weeds.
   v. Cease all project operations, except efforts to minimize storm or high flow erosion, under high flow conditions that result in inundation of the project area.
   vi. Stockpile native streambed materials above the bankfull elevation for later use in project restoration. To prevent contamination from fine soils, these materials shall be kept separate from other stockpiled material, which is not native to the streambed.

f. **Minimize Stream Crossing Sedimentation** – Methods to minimize turbidity and sedimentation resulting from use of stream crossings and access roads include the following:
   i. No equipment is permitted in the flowing water portion of the stream channel except at designated stream crossings.
   ii. Where temporary stream crossings are essential, crossings shall be identified on project plans, designated at the project site, shall not increase risks of channel re-routing due to high water conditions, and avoid potential spawning areas when possible.
   iii. Stream and riparian crossings shall be minimized and conducted at right angles to the main channel where possible.
   iv. Existing roadways or travel paths will be used whenever reasonable.

g. **Minimize Sedimentation through Dewatering** – To minimize project related sediment introduced into the stream and to help meet state turbidity standards, methods to isolate the in-channel project includes the following:
   a. Divert flow with pumps or structures such as cofferdams constructed with non-erosive devices, such as sandbags, bladder bags, or other means that divert water. Diversion dams constructed with material mined from the stream or floodplain is not permitted.
   b. The temporary bypass system may consist of non-erosive techniques, such as a pipe or a plastic-lined channel, both of which must be sized large enough to

accommodate the predicted peak flow rate during construction. In cases of channel rerouting, water can be diverted to one side of the existing channel.

- **c.** Dissipate flow at the outfall of the bypass system to diffuse erosive energy of the flow. Place the outflow in an area that minimizes or prevents damage to riparian vegetation. If the diversion inlet is not screened to allow for downstream passage of fish, place diversion outlet in a location that facilitates safe reentry of fish into the stream channel.
- **d.** When necessary, pump water from the de-watered work area to a temporary storage and treatment site or into upland areas and filter through vegetation prior to reentering the stream channel.
- **e.** Any water intake structure (pump) authorized under this BA must have a fish screen installed, operated and maintained in accordance to NMFS' fish screen criteria (NMFS,1995) (http://www.nwr.noaa.gov/1hydrop/hydroweb/ferc.htm

h. Flow Reintroduction

- **i.** Slowly re-water the construction site to prevent loss of surface water downstream as the construction site streambed absorbs water and to prevent a sudden increase in stream turbidity. Look downstream during re-watering to prevent stranding of aquatic organisms below the construction site.

j. Site Restoration – Methods to minimize sedimentation through site restoration include the following:

- **i.** Upon project completion, remove project related waste. Initiate rehabilitation of all disturbed areas in a manner that results in similar or better than pre-work conditions through spreading of stockpiled materials, seeding, and/or planting with native seed mixes or plants. If native stock is not available, use soil-stabilizing vegetation (seed or plants) that does not lead to propagation of exotic species.
- **ii.** For culvert removal or bridge projects, reconstruct the stream channel cross-section and gradient within the area formerly occupied by a culvert in a manner that reflects more natural conditions found up and downstream. Large wood and/or boulders may be placed in the reconstructed stream channel and floodplain.
- **iii.** No herbicide application will occur as part of the permitted action. Mechanical removal of undesired vegetation and root nodes is permitted.
- **iv.** When necessary, loosen compacted access roads, stream crossings, stream channel within the dewatered work area, staging, and stockpile areas.
- **v.** In-stream or floodplain restoration materials—such as large wood and boulders—shall mimic as much as possible those found in the project vicinity. Such materials may be salvaged from the project site or hauled in from offsite but cannot be taken from streams, wetlands, or other sensitive areas. Use cable in project design sparingly and only when conditions do not exist to anchor large wood naturally between riparian trees or to protect downstream structures.
- **vi.** Do not fell conifers in the riparian area for restoration purposes unless conifers are fully stocked or if necessary for safety. If necessary for safety, fell trees toward the stream and leave in place or place them in the stream channel or floodplain. This does not apply to conifer removal in areas necessary for

project completion—staging and stockpile areas, road fill around the culvert, access roads, etc. etc.

vii. When necessary, use steep-slope terracing.

viii. Complete necessary site restoration activities within five days of the last construction phase.

H. Conservation Measures for Terrestrial Species and Habitats

Project Design Criteria are measures applied to project design and implementation by the action agency, and are designed to minimize the potential detrimental effects to listed and proposed threatened and endangered species or critical habitat. The following criteria are **mandatory** in order for the "not likely to adversely affect" determinations made for projects included in this Biological Assessment to be valid. If these criteria cannot be met, **then the project falls outside the scope of this programmatic consultation, and a separate formal Section 7 consultation must be initiated for the project.**

The northern spotted owl and marbled murrelet are the only species for which "may affect, likely to adversely affect" determinations have been made due to potential harassment effects of some fish passage improvement projects that will be implemented during periods associated with nesting. The project design criteria identified below should be applied to the extent possible to minimize adverse effects for these species. When projects are implemented during the seasonal restriction periods and known sites and/or potential habitat may be adversely affected, this must be documented to determine the amount of "incidental take" associated with the project. If this level is exceeded**,** Section 7 consultation must be reinitiated. This process is described in further detail in the following sections for these species.

1. **Birds**
   a. **Bald Eagle**
      BE1: No known bald eagle nest trees, perch trees, or roost trees will be felled or modified.
      BE2: Suitable bald eagle habitat will not be removed within 0.25 miles (approximately 400 meters) of nest or roost sites.
      BE3: Potential eagle perches (large snags, dead top trees or other suitable sites) within 0.5 mile (800 meters) of nests or roosts will not be felled.
      BE4: Work activities will not take place within 0.25 mile (approximately 400 meters) of active nests/roosts, or within 0.5-mile (approximately 400 meters) line-of-sight from nests/roosts during periods of eagle use, unless surveys demonstrate that the nest or roost is not being used. Critical nesting periods generally fall between 1 January and 31 August.
      BE5: Key wintering areas will be protected from disturbance from approximately 15 November to 15 March.
      BE6: Meet direction in Forest or District draft or final site management plans for eagle nest or roost sites.

b. Marbled Murrelet

MM1: No suitable or potential marbled murrelet habitat is removed.
MM2: The project is implemented between August 6 and September 15, and noise-disturbing activities do not occur during the periods when chicks are being fed (2 hours after sunrise and 2 hours before sunset).
MM3: The project is implemented between April 1 and August 6 but it is located farther than 75 yards from a known occupied site, or unsurveyed suitable or potential marbled murrelet habitat if noise will be above ambient levels, OR is farther than 120 yards if helicopters will be used, OR is farther than 270 yards if blasting will occur.
MM4: No more than 1 acre of forested areas defined as a primary constituent element of marbled murrelet critical habitat is removed.
MM5: Garbage containing food and food trash generated by workers in project areas is secured or removed to minimize attraction of corvids, which have been identified as predators of murrelet eggs and young.

For the **Mt. Baker-Snoqualmie and Olympic NFs**, an estimated 10 projects per year over the 5-year period covered by this Biological Assessment "may affect, and are likely to adversely affect" the marbled murrelet because of harassment effects due to implementation during the early nesting period from April 1 until August 6. The majority of these projects will generate noise above ambient levels from use of heavy equipment (excavators, bulldozers, and front-end loaders). It is estimated that one of the 10 projects each year will generate higher noise/disturbance levels associated with helicopters, pile drivers or blasting. For the **Gifford Pinchot NF**, where less of the Forest is within the range of the species, an estimated 5 projects per year "may affect, and are likely to adversely affect" the murrelet due to harassment, and one of these projects per year will involve higher noise/disturbance levels.

The following is an estimated total number of acres of suitable or potential habitat on each Forest that may be adversely affected by harassment related to project activities over the 5-year period covered by this Biological Assessment, assuming 4 acres/project (within 75 yards) may be affected by noise above ambient levels associated with heavy equipment use, and up to 50 acres/project (within 270 yards) may be affected by helicopter or pile driver use or blasting. The assumptions and process used to assess harassment and derive acre estimates were taken from USDI Fish and Wildlife Service, Western Washington Fish and Wildlife Office. 2002. Biological Opinion of the Effects of Mt. Baker Snoqualmie National Forest Program Activities for 2003-2007 on Marbled Murrelets and Northern Spotted Owls. FWS Reference Number 1-3-02-F-1583. Prepared by Kent Livezey, Cindy Levy, and Mark Hodgkins.

Mt. Baker-Snoqualmie NF: 430 acres (annual maximum 132 acres)
Olympic NF: 430 acres (annual maximum 132 acres)
Gifford Pinchot NF: 330 acres (annual maximum 112 acres)

If a project may affect suitable or potential habitat due to harassment, each Forest must document the estimated number of acres on an **annual** basis. If the number of acres exceeds the "annual maximum" identified above, then consultation must be reinitiated. The annual maximum was estimated to allow the possibility of more than one project with higher noise/disturbance levels per year, or a higher number than the estimated number of projects with lower disturbance levels in a year.

c. **Northern Spotted Owl**

NSO1: If an active spotted owl nest or activity center is located within or adjacent to a project area, delay the project activity until September 30 or until it is determined that young are not present. (For a given situation, the "adjacent distance" is determined by the action agency biologist-- if needed, contact the Level 1 team for guidance. At a minimum, if an activity could cause a roosting spotted owl to flush, it is considered "adjacent".)

NSO2: Project associated work activities that produce noise above ambient level, will not occur within 75 yards of any nest site or activity center of known pairs and resident singles (or unsurveyed suitable habitat) between March 1 and July 15 in Washington and between March 1 and September 30 in Oregon. The restricted zone during these periods extends to 120 yards for helicopter use, and 270 yards for blasting. March 1 – June 30 is considered the critical early nesting period; the action agency biologist has the option to extend the restricted season based on site-specific information (such as a late or recycle nesting attempt).

NSO3: No more than 1-acre of suitable or dispersal habitat may be degraded, per project, within critical habitat.

For the **Mt. Baker-Snoqualmie, Olympic, and Gifford Pinchot NFs**, an estimated 10 projects per year over the 5-year period covered by this Biological Assessment "may affect, and are likely to adversely affect" the northern spotted owl because of harassment effects due to implementation during the nesting period (adverse effects could occur March 1 through July 15 in Washington, March 1 through September 30 in Oregon). The majority of these projects will generate noise above ambient levels from use of heavy equipment (excavators, bulldozers, and front-end loaders). It is estimated that one of the 10 projects each year will generate higher noise/disturbance levels associated with helicopters, pile drivers or blasting. For the **Okanogan-Wenatchee NF,** which has less overall area within the range of the owl, an estimated 5 projects per year "may affect, and are likely to adversely affect" the owl due to harassment, and one of these projects per year will involve higher noise levels. For the **Fremont-Winema NF and Deschutes NF** in Oregon**,** which also have less overall area within the range of the owl but have a longer period when disturbance is considered an adverse effect, an estimated 6 projects per year for the **Fremont-Winema NF** and 7 projects per year for the **Deschutes NF** "may affect, and are likely to adversely affect" the owl due to harassment, and one of these projects per year will involve higher noise levels.

The following is an estimated total number of acres of owl suitable habitat on each Forest that may be adversely affected by harassment related to project activities over the 5-year period covered by this Biological Assessment, assuming 4 acres/project (within 75 yards) may be affected by noise above ambient levels, and up to 50 acres/project (within 270 yards) may be affected by helicopter use or blasting. The assumptions and process used to assess harassment and derive acre estimates were taken from USDI Fish and Wildlife Service, Western Washington Fish and Wildlife Office. 2002. Biological Opinion of the Effects of Mt. Baker Snoqualmie National Forest Program Activities for 2003-2007 on Marbled Murrelets and Northern Spotted Owls. FWS Reference Number 1-3-02-F-1583. Prepared by Kent Livezey, Cindy Levy, and Mark Hodgkins.

Mt. Baker-Snoqualmie NF – 430 acres (**annual maximum 132 acres**)
Olympic NF – 430 acres (**annual maximum 132 acres**)
Gifford Pinchot NF – 430 acres (**annual maximum 132 acres**)
Okanogan-Wenatchee NF – 330 acres (**annual maximum 112 acres**)
Deschutes NF – 370 acres (**annual maximum 120 acres**)
Winema NF – 350 acres (**annual maximum 116 acres**)

If a project may affect suitable habitat due to harassment, each Forest must document the estimated number of acres on an **annual** basis. If the number of acres exceeds the "annual maximum" identified above, then consultation must be reinitiated. The annual maximum was estimated to allow the possibility of more than one project with higher noise/disturbance levels per year, or a higher number than the estimated number of projects with lower disturbance levels in a year.

2. Mammals

a. Canada Lynx

CL1: No active lynx dens are located within 270 yards (based on sight distance and attenuation of sound in forested environments of a project.
CL2: No suitable habitat will be degraded or removed.
CL3: The project will not result in increased off-road vehicle access to lynx habitat during or following implementation.

b. Gray Wolf

GW1: No active den or rendezvous site or pack activity is located within 1.5-miles of the project (Chapman 1979). If an active den, rendezvous site, or pack activity if identified, the project would fall outside the scope of this Biological Assessment, and a separate consultation would be required to address potential effects.

c. Grizzly Bear

GB1: Projects generating noise above ambient levels within ¼ mile (1 mile for blasting) of any known grizzly bear den site will not occur from October 15 through May 15
GB2: Projects generating noise above ambient levels and located within ¼ mile (1.0 mile for blasting) of early season grizzly bear foraging areas (e.g., low elevation grass/forb habitat, deciduous forest, riparian forest, shrub fields, montane meadows, avalanche chutes) will not occur from March 15 to July 15 if the activity will last for more than one day.
GB3: Projects generating noise above ambient levels and located within ¼ mile (1.0 mile for blasting) of late season grizzly bear foraging areas [e.g., high elevation berry fields, shrub fields, fruit/nut sources, wet forest openings, alpine and sub alpine meadows, montane meadows (moist, cool, upland slopes dominated

by coniferous trees)] will not occur from July 16 to November 15 if the activity will last for more than one day.
GB4: Projects will not increase trail or road densities within grizzly bear core habitat. No road or trail construction or reconstruction will occur in recovery areas.
GB5: All attractants, including food and garbage, will be stored in a manner unavailable to wildlife at all times.

d. **Woodland Caribou**
WC1: Projects that are scheduled during early winter in the caribou recovery area (Michael Borysewicz pers. com.2003) and generate noise above ambient levels will be evaluated by the local wildlife biologist to determine if there will be disturbance effects to caribou.
WC2: Any vegetation management will not affect more than 1.0 acre of native forest per year.
WC3: Projects will not result in increased off-road vehicle access to caribou habitat.

3. **Plants**
For **threatened or endangered plant species** that may occur in project areas within the scope of this Biological Assessment, the following criteria will be applied:
   a. **PL1:** If, after pre-field review, the botanist determines that a known site of a listed plant is within 0.25-mile of the project action area or that suitable or potential habitat may be affect by project activities, the project site will be evaluated through a site visit and vegetation survey conducted by a botanist. This visit and survey will be conducted at the appropriate time of year to identify the species and determine whether individual listed plants or potential habitat are present, and may be adversely affected by project activities.
   b. **PL2:** If one or more listed species are present and may be affected by the project, the project is not covered by this Biological Assessment and consultation with the U.S. Fish and Wildlife Service under Section 7 of the ESA must be initiated.
   c. **PL3:** Due to soil disturbance that will occur, and use of heavy equipment that could carry seeds and plant parts into project areas, all appropriate measures will be incorporated into contract or equipment rental agreements to avoid introduction of invasive plants and noxious weeds into project areas.

I. Annual Monitoring and Reporting Requirements

1. **Annual Reporting**
   Report projects implemented under the subsequent BO through the Interagency Restoration Database (IRDA) administered by the Regional Ecosystem Office. Reporting elements will include the following: Project ID, Project Name, Location, Culvert removal or replacement, width and slope of impassable culvert, fish species/ESU (and life history stages) above and below impassable culvert, bankfull width and slope of stream channel, designation of channel substrate, new structure type, width and slope of new structure, miles opened to fish passage, number of injuries/mortalities to ESA-listed fish, incidental take of Marbled Murrelets and/or Northern Spotted Owls. Reporting through IRDA shall be completed by December 15 of each year.
2. **Monitoring**
   Monitor the structure after high flow events, which occur during the first fall/winter/spring after project completion. Assess the following parameters:
   a. Headcutting below the natural stream gradient.
   b. Substrate embeddedness in the culvert.
   c. Scour at the culvert outlet
   d. Erosion from sites associated with project construction

   The absence of headcutting, degradation of embedded substrate, and a scour pool at the outlet indicates that stream simulation goals have been met. The presence of headcutting, degradation of embedded substrate, and a scour pool at the outlet indicate that stream simulation goals have not been met. In such cases, certain remedial actions—restoration of culvert embeddedness—that are addressed in the construction methods of this chapter and the effects of programmatic actions in Chapter V are permitted without additional consultation.

J. Project Management

1. **Project Managers**
   At the programmatic scale, the Regional Engineer shall be the project manager. At the Forest level, the Forest Engineer will serve as the project manager. The project managers will serve as initial contacts for the FWS and NOAA Fisheries when information concerning a programmatic action is requested.
2. **Annual Field Review**
   Conduct annual field reviews of sample projects and include personnel from FWS, NOAA Fisheries, and FS. Feedback on projects should be formalized from FWS and NOAA Fisheries to the FS. Sample sites shall include different stream and structure types to ensure that a range of projects covered by the programmatic are reviewed. Annual field reviews will be coordinated through the Regional Engineer.

III. Description of the Affected Species

The following species descriptions summarize biological requirements and may include other elements, such as historical numbers and distribution, which offer insights into the life histories of affected ESA-listed fish, wildlife, and plants.

A. Fish

1. Bull Trout (*Salvelinus confluentus*)

On November 1, 1999, the U.S. Fish and Wildlife Service (FWS) listed five distinct populations segments (DPSs) of the bull trout within the coterminous United States as threatened (USDI 1999). These five DPSs, with 187 subpopulations, include: 1) the Coastal/Puget Sound DPS, with 34 subpopulations; 2) the Columbia River DPS, with 141 subpopulations; 3) the Jarbidge River DPS, with 1 subpopulation; 4) the St. Mary-Belly River DPS, with four subpopulations; and 5) the Klamath River DPS, with seven subpopulations. The factors that have contributed to the decline of bull trout population within each DPS include the restriction of migratory routes by dams and other unnatural barriers; forest management, grazing, and agricultural practices; road construction; mining; introduction of non-native species; and residential development resulting in adverse habitat modification, excessive timber harvest, and poaching (Bond 1992, Thomas 1992, Rieman and McIntyre 1993, Donald and Alger 1993, WDFW 1997). Critical habitat has been proposed only for the Columbia River and Klamath River DPSs.

The Service is currently developing the recovery plans for the Columbia River and Coastal/Puget Sound DPSs, and the bull trout recovery planning efforts are converting bull trout subpopulations into core areas. Core areas, which form the basic geographic unit upon which to gage recovery within a recovery unit, contain both core habitat (i.e., habitat that could supply all elements for the long-term security of bull trout) and a core population (i.e., bull trout inhabiting core habitat). Core areas were designated to represent the closest approximation of a healthy functioning subpopulation within each DPS.

In general, the concept of core areas were originally established with the intent to achieve optimal environmental conditions, as proposed by Rieman and McIntrye (1993) (see Lohr et al. 2001). More recently, the bull trout recovery planning team has expanded the focus of core areas to also address restoration activities and other prudent measures considered necessary for bull trout recovery. As a result of these efforts, the 141 subpopulations within the Columbia River DPS and the 34 Coastal-Puget Sound DPS subpopulations will have 88 and 14 core areas, respectively.

Life History - Bull trout are a member of the char family and closely resemble another member of the char family, Dolly Varden (*Salvelinus malma*). Genetics indicate, however, that bull trout are more closely related to an Asian char (*Salvelinus leucomaenis*) than they are to Dolly Varden. Bull trout are sympatric with Dolly Varden over part of their range, most notably in British Columbia and the Coastal/Puget Sound region of Washington State.

Bull trout distribution has been reduced by an estimated 55 percent in the Klamath River DPS and 79 percent in the Columbia River DPS since pre-settlement times, due primarily to local extirpations, habitat degradation, and isolating factors (Quigley and Arbelride 1997). Within the Puget Sound Basin, bull trout distribution is similar to historic distributions, but population abundance has significantly decreased. Bull trout historically occurred in major river drainages in the Pacific Northwest, extending from northern California to the headwaters of the Yukon River in the Northwestern Territories of Canada (Cavender 1978; Bond 1992). In California, bull trout were historically found only in the McCloud River, which represented the southernmost extension of the species' ranges. The last confirmed report of this species in the McCloud River was in 1975, and the original population is now considered to be extirpated (Rode 1990). The remaining distribution of bull trout is highly fragmented.

Bull trout currently occur in rivers and tributaries in Montana, Idaho, Washington, Oregon (including the Klamath River basin), Nevada, two Canadian Provinces (British Columbia and Alberta), and several cross-boundary drainages in extreme southeast Alaska. East of the Continental Divide, bull trout are found in the headwaters of the Saskatchewan River in Alberta, and the McKenzie River system in Alberta and British Columbia (Cavender 1978; McPhail and Baxter 1996; Brewin and Brewin 1997).

Bull trout populations exhibit four distinct life history types: resident, fluvial, adfluvial, and anadromous. Fluvial, adfluvial, and resident forms exist throughout the range of the bull trout (Rieman and McIntyre 1993) and spend their entire life in freshwater. The only known anadromous life history form within the coterminous United States occurs in the Coastal/Puget Sound region (Volk, 2000; Kraemer 1994; Mongillo 1993). Highly migratory populations have been eliminated from many of the largest, most productive river systems across their range. Many "resident" bull trout presently exist as isolated remnant populations in the headwaters of rivers that once supported larger, more fecund migratory forms. These remnant populations that lack connectivity to migratory populations have a low likelihood of persistence (Rieman and McIntyre 1993; Rieman and Allendorf 2001).

The majority of the growth and maturation of anadromous bull trout occurs in estuarine and marine waters; for adfluvial bull trout, the major growth and maturation occurs in lakes or reservoirs; and for fluvial bull trout, the major growth and maturation occurs in large river systems. Resident bull trout populations are generally found in small headwater streams where the fish tend to spend their entire lives. These diverse life history types are important to the stability and viability of bull trout populations (Rieman and McIntyre 1993).

For all life history types, the juveniles tend to rear in tributary streams for 1 to 3 years before migrating downstream into a larger river, lake, or estuary and/or near shore marine area to mature (Rieman and McIntyre 1993). In some lake systems, age 0+ fish may migrate directly to lakes (Riehle et al. 1997). Juvenile and adult bull trout frequently inhabit side channels, stream margins and pools with suitable cover

(Sexauer and James 1993) and areas with cold hyporheic or groundwater upwellings (Baxter and Hauer 2000).

Bull trout become sexually mature between four and nine years of age, and may spawn in consecutive or alternate years (Shepard *et al.* 1984; Pratt 1992). Spawning typically occurs from August through December in cold, low-gradient 1^{st}- to 5^{th}-order tributary streams, over loosely compacted gravel and cobble having groundwater inflow (Shepard *et al.* 1984; Brown 1992; Rieman and McIntyre 1996; Swanberg 1997; MBTSG 1998; Baxter and Hauer 2000). Spawning sites frequently occur near cover (Brown 1992). Migratory bull trout may begin their spawning migrations as early as April and have been known to migrate upstream as far as 250 kilometers (155 miles) to spawning grounds (Fraley and Shepard 1989). Hatching occurs in winter or early spring, and alevins may stay in the gravel for up to three weeks before emerging from the gravel. The total time from egg deposition to fry emergence from the gravel may exceed 220 days. Post-spawning mortality, longevity, and repeat-spawning frequency are not well known (Rieman and McIntyre 1996), but life spans may exceed 10-13 years (McPhail and Murray 1979; Pratt 1992; Rieman and McIntyre 1993).

Bull trout are apex predators, and require a large prey base and home range. Adult and sub-adult migratory bull trout are primarily piscivorous, feeding on various trout and salmon species, whitefish, yellow perch (*Perca flavescens*), and sculpin. Sub-adult and adult migratory bull trout move throughout and between basins in search of prey. Anadromous bull trout in the Coastal/Puget Sound DPS also feed on ocean fish such as surf smelt (*Hypomesus pretiosus*) and sandlance (*Ammodytes hexapterus*). Resident and juvenile bull trout prey on terrestrial and aquatic insects, macrozooplankton, amphipods, mysids, crayfish, and small fish (Wyman 1975; Rieman and Lukens 1979 in Rieman and McIntyre 1993; Boag 1987; Goetz 1989; Donald and Alger 1993). A recent study in the Cedar River Watershed of western Washington found bull trout diets to also consist of aquatic insects, crayfish, and salamanders (Connor *et al.* 1997).
Habitat Requirements – Bull trout have more specific habitat requirements than other salmonids (Rieman and McIntyre 1993). Growth, survival, and long-term persistence are dependent upon the following habitat characteristics: cold water, complex instream habitat, a stable substrate with a low percentage of fine sediments, high channel stability, and stream/population connectivity. Stream temperature and substrate type, in particular, are critical factors for the sustained long-term persistence of bull trout. Spawning is often associated with the coldest, cleanest, and most complex stream reaches within basins. However, bull trout exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1995), and should not be expected to occupy all available habitats at the same time (Rieman et al. 1997).

While bull trout clearly prefer cold waters and nearly pristine habitat, it cannot be assumed that they do not occur in streams where habitat is degraded. Given the depressed status of some subpopulations, it is likely that individuals in degraded rivers are utilizing less than optimal habitat because that may be all that is available. In basins with high productivity, such as the Skagit River basin, bull trout may be using marginal areas when optimal habitat becomes fully occupied (Kramer, WDFW, pers.

com.). Bull trout have been documented using habitats that may be atypical or characterized as likely to be unsuitable (USFWS 2000).
Temperature – For long-term persistence, bull trout populations need a stream temperature regime that ensures that sufficient amounts of cold water are present at the locations and during the times needed to complete their life cycle. Temperature is most frequently recognized as the factor limiting bull trout distribution (Dunham and Chandler 2001; Rieman and McIntyre 1993). Probability of occurrence for juvenile bull trout in Washington is relatively high (75%) when maximum daily temperatures did not exceed approximately 11- 12 ° C (Dunham et al. 2001). Water temperature also seems to be an important factor in determining early survival, with cold-water temperatures resulting in higher egg survival and faster growth rates for fry and juveniles (Pratt 1992). Optimum incubation temperatures range from 2° to 6° C. At 8° C to 10° C, survival ranged from 0-20 percent (McPhail and Murray 1979). Stream temperatures for tributary rearing juvenile bull trout are also quite low, ranging from 6° to 10° C (Buchanan and Gregory 1997; Goetz 1989; Pratt 1992; McPhail and Murray 1979).

Increases in stream temperatures can cause direct mortality, increased susceptibility to disease or other sublethal effects, displacement by avoidance (McCullough et al. 200;, Bonneau and Scarnechia 1996), or increased competition with species more tolerant of warm stream temperatures (Rieman and McIntyre 1993; Craig and Wissmar 1993 cited in USDI (1997a); MBTSG 1998). Brook trout, which can hybridize with bull trout, may be more competitive than bull trout and displace them, especially in degraded drainages containing fine sediment and higher water temperatures (Clancy 199;, Leary *et al.* 1993). Recent laboratory studies suggest bull trout are at a particular competitive disadvantage in competition with brook trout at temperatures >12° C (McMahon et al. 2001).

Although bull trout require a narrow range of cold-water temperatures to rear, migrate, and reproduce, they are known to occur in larger, warmer river systems that may cool seasonally, and which provide important migratory corridors and forage bases. For migratory corridors, bull trout typically prefer water temperatures ranging between 10°-12° C (McPhail and Murray 1979; Buchanan and Gregory 1997). When bull trout migrate through stream segments with higher water temperatures they tend to seek areas offering thermal refuge such as confluences with cold tributaries (Swanberg 1997), deep pools, or locations with surface and groundwater exchanges in alluvial hyporheic zones (Frissell 1999). Water temperatures above 15° C are believed to limit bull trout distribution, which partially explains their generally patchy distribution within a watershed (Fraley and Shepard 1989; Rieman and McIntyre 1995).
Substrate – Bull trout show a strong affinity for stream bottoms and a preference for deep pools in cold-water streams (Goetz 1989; Pratt 1992). Stream bottom and substrate composition are highly important for juvenile rearing and spawning site selection (Graham et al 1981; McPhail and Murray 1979). Fine sediments can influence incubation survival and emergence success (Pratt 1992) but might also limit access to substrate interstices that are important cover during rearing and over-wintering (Goetz 1994; Jakober 1995). Rearing densities of juvenile bull trout have

been shown to be lower when there are higher percentages of fine sediment in the substrate (Shepard *et al.* 1984). Due to this close connection to substrate, bed load movements and channel instability can negatively influence the survival of young bull trout.

Cover and stream complexity – Bull trout of all age classes are closely associated with cover, especially during the day (Baxter and McPhail1997; Fraley and Shepard 1989). Cover may be in the form of overhanging banks, deep pools, turbulence, large wood, or debris jams. Young bull trout use interstitial spaces in the substrate for cover and are closely associated with the streambed. This association appears to be more important for bull trout than for other salmonid species (Pratt 1992, Rieman and McIntyre 1993).

Bull trout distribution and abundance is positively correlated with pools and complex forms of cover, such as large or complex woody debris and undercut banks, but may also include coarse substrates (cobble and boulder) (Rieman and McIntyre 1993; Jakober 1995; MBTSG 1998). Studies conducted with Dolly Varden showed that population density declined with the loss of woody debris after clearcutting or the removal of logging debris from streams (Bryant 1983; Dolloff 1986; Elliott 1986; Murphy *et al*. 1986).

Large pools, consisting of a wide range of water depths, velocities, substrates, and cover, are characteristic of high quality aquatic habitat and an important component of channel complexity. Reduction of wood in stream channels, either from present or past activities, generally reduces pool frequency, quality, and channel complexity (Bisson *et al.* 1987; House and Boehne 1987; Spence *et al.* 1996). Large wood in streams enhances the quality of habitat for salmonids and contributes to channel stability (Bisson *et al.* 1987). It creates pools and undercut banks, deflects streamflow, retains sediment, stabilizes the stream channel, increases hydraulic complexity, and improves feeding opportunities (Murphy 1995). By forming pools and retaining sediment, large wood also helps maintain water levels in small streams during periods of low stream flow (Lisle 1986).

Channel and hydrologic stability – Due to the bull trout's close association to the substrate, bed load movements and channel instability can reduce the survival of young bull trout. Maintaining bull trout habitat requires stream channel and flow stability (Rieman and McIntyre 1993). Bull trout are exceptionally sensitive to activities that directly or indirectly affect stream channel integrity. Juvenile and adult bull trout frequently inhabit areas of reduced water velocity, such as side channels, stream margins, and pools that are easily eliminated or degraded by management activities (Rieman and McIntyre 1993). Channel dewatering caused by low flows and bed aggradation has blocked access for spawning fish resulting in year class failures (Weaver 1992). Timber harvest and the associated roads may cause landslides that affect many miles of stream through aggradation of the streambed.

Patterns of stream flow and the frequency of extreme flow events that influence substrates may be important factors in population dynamics (Rieman and McIntyre 1993). With lengthy overwinter incubation and a close tie to the substrate, embryos and juveniles may be particularly vulnerable to flooding and channel scour associated with the rain-on-snow events that are common in some parts of the range (Rieman and McIntyre 1993). Surface/groundwater interaction zones, which are typically selected by bull trout for redd construction, are increasingly recognized as having high dissolved oxygen, constant cold-water temperatures, and increased macro-invertebrate production.

Migration – The persistence of migratory bull trout populations requires maintaining migration corridors. Stream habitat alterations which restrict or eliminate bull trout migrations corridors include degradation of water quality (especially increasing temperatures and increased amounts of fine sediments), alteration of natural stream flow patterns, impassable barriers (such as dams and culverts), and structural modification of stream habitat (such as channelization or removal of cover). In the Coastal/Puget Sound DPS, migratory corridors may link seasonal marine and freshwater habitats as well as linking lake, river and tributary complexes that are necessary for bull trout completion of their life history requirements.

The importance of maintaining the migratory life history form of bull trout, as well as migratory runs of other salmonids that may provide a forage base for bull trout, is repeatedly emphasized in the scientific literature ((Rieman and McIntyre 1993, MBTSG 1998; Dunham and Rieman 1999; Nelson *et al.* 2002). Isolation and habitat fragmentation resulting from migratory barriers have negatively affected bull trout by: (1) reducing geographical distribution (Rieman and McIntyre 1993; MBTSG 1998); (2) increasing the probability of losing individual local populations (Rieman and McIntyre 1993; MBTSG 1998; Nelson *et al.* 2002; Dunham and Rieman 1999); (3) increasing the probability of hybridization with introduced brook trout (Rieman and McIntyre 1993); (4) reducing the potential for movements in response to developmental, foraging, and seasonal habitat requirements (MBTSG 1998; Rieman and McIntyre 1993); and (5) reducing reproductive capability by eliminating the larger, more fecund migratory form from many subpopulations (MBTSG 1998; Rieman and McIntyre 1993). Therefore, restoring connectivity and restoring the frequency of occurrence of the migratory form will be an important factor in providing for the recovery of bull trout.

Unfortunately, migratory bull trout have been restricted or eliminated in parts of their range due to stream habitat alterations, including seasonal or permanent obstructions, detrimental changes in water quality, increased temperatures, and the alteration of natural stream flow patterns. Dam and reservoir construction and operations have altered major portions of bull trout habitat throughout the Columbia River basin. Dams without fish passage create barriers to fluvial and adfluvial bull trout which isolates populations. The operations of dams and reservoirs alter the natural hydrograph, thereby affecting forage, water temperature, and water quality (USDI 1997a).

Marine Phase - Anadromous bull trout forage and mature in the nearshore marine habitats on the Washington coast and in the Puget Sound. These nearshore marine habitats have been significantly altered by human development (PSWQAT 2000). Construction of bulkheads and other structures have modified the nearshore areas and resulted in habitat loss that has directly affected forage fish for bull trout. Other impacts to the marine environment include alterations to water quality resulting from pathogens, nutrients and toxic contaminants, urbanization and storm water runoff from basins that feed the Puget Sound. Global changes in sea level and climate may also have more widespread ramifications on these habitats and the Puget Sound ecosystem as a whole (Klarin et al. 1990; Thom 1992). The marine and estuarine residency period for bull trout is poorly understood. The lack of data requires using literature for other species, such as Dolly Varden and cutthroat trout. Thorpe's (1994) review of salmonid estuarine use found that anadromous Dolly Varden stay close to the shoreline. He found little evidence in the literature that the estuary was used for physiological adjustment or as a refuge from predation but did find clear evidence of a trophic advantage to estuarine residency (abundant prey). Aitkin (1998) reviewed the estuarine habitat of anadromous salmon, including native char, and found that Dolly Varden pass through estuaries while migrating and inhabit coastal waters.

While in the estuary, native char can grow very quickly. Sub-adults grow from 20 to 40 mm per month and reach a length of 250 to 350 mm before their upstream migration in late summer and early fall (Kraemer 1994). Smith and Slaney (1979) studied Dolly Varden from 1975 to 1978 on Vancouver Island. They found that first time spawners were generally 400 to 525 mm in length, that Dolly Varden sub-adults average 280 mm (150 mm to 470 mm) during their upstream migration after their first ocean migration, and that sub-adults gained 74 mm and adults 45 mm in length during their marine residency.

In a lacustrine environment, Dolly Varden were found to have a different feeding strategy than cutthroat trout. In an experimental observation tank, Dolly Varden fed on benthos by searching close to the bottom at a constant speed and sorting bottom grabs and mouthfuls of sand for buried prey (Schultz and Northcote 1972). Henderson and Northcote (1985) also found that Dolly Varden were capable of foraging in light conditions that were one or two orders lower than cutthroat trout when searching for prey.

Kraemer (1994) speculated that the distribution of native char in marine waters may be closely timed to the distribution of baitfish and coincident with their spawning beaches. Char from Puget Sound have been found to prey on surf smelt, Pacific herring, Pacific sand lance, pink salmon smolts, chum salmon smolts, and a number of invertebrates (Kraemer 1994). The Quinault Indian Nation (*in litt.* 1995) documented smelt as a prey item for native char in the Queets River.

The Alaska Department of Fish and Game (1963) studied Dolly Varden on Afognak Island, Alaska. They found that Dolly Varden migrate to the sea in the spring and return to fresh water in the fall. Some Dolly Varden were found as far as 30 miles off shore. Kraemer (1994) has documented fish in Puget Sound as far as 25 miles from their natal stream. Armstrong (1965) conducted a massive marking study (thousands of fish) in southeast Alaska to determine the migratory habits of anadromous Dolly Varden. He found that the marked fish were found in 25 different stream systems as far as 72 miles from their natal stream. Some fish became widely distributed in a short period of time (3 to 10 days). They spent an average of 116 days in marine waters. About forty percent of the marked fish appeared to stray or migrate to other streams during the winter. He also reported that Dolly Varden migrated directly to saltwater and did not backtrack or linger in the river; the fish appeared to be absent from marine waters from December to March; downstream migration began in late March and ended in mid-July; and upstream migration continued from late May to early December.

Smith and Slaney (1979) found downstream migration of Dolly Varden occurred from mid-March to mid-June and upstream migration occurred from mid-July to the end of October. DeCicco (1992) showed that movements of anadromous Dolly Varden are much greater than previously known, are not always coastal in nature, and suggest movement of stocks over a wide geographic area (freshwaters of Alaska and the Soviet Union). Thorpe (1994) indicated that Dolly Varden were found in regions close to river mouths, within meters of the shoreline, but may also travel several hundred kilometers from their natal river's mouth. Kraemer (as cited in Nightengale and Simenstad 2001) observed that native char foraging in the estuary in less than 3 meters of water and were often seen foraging in water less than 0.5 meters deep. He also indicated that they tend to remain within tens of miles from their natal streams.

DPS in Washington - The Service analyzed data on bull trout relative to sub-populations because fragmentation and barriers have isolated bull trout throughout their current range. A sub-population is considered a reproductively isolated group of bull trout that spawns within a particular area of a river system. Sub-populations were considered at risk of extirpation from naturally occurring events if they were: 1) unlikely to be reestablished by individuals from another sub-population; 2) limited to a single spawning area; and, either 3) characterized by low individual or spawner numbers; or 4) primarily of a single life-history form. The Service rated a subpopulation as either "strong," "depressed," or "unknown," modified after Rieman et al. (1997). A sub-population is considered "strong" if 5,000 individuals or 500 spawners likely occur in the sub-population, abundance appears stable or increasing, and life-history forms were likely to persist; and "depressed" if less than 5,000 individuals or 500 spawners likely occur in the sub-population, abundance appears to be declining, or a life-history form historically present has been lost. If there was insufficient abundance, trend, and life-history information to classify the status of a sub-population as either "strong" or "depressed", the status was considered "unknown".

The WDFW also has a rating system for native char subpopulations, The 1998 Washington Salmonid Stock Inventory for bull trout and Dolly Varden (WDFW 1998) states, "The healthy category covers a wide range of stock performance levels, from consistently robust production to those stocks that may be maintaining sustainable levels without providing any surplus production for directed harvests. In other words, the fact that a stock may be classified as healthy in the inventory process does not necessarily mean that managers have no current concerns about its production status" (WDFW 1998). WDFW (1998) defines a stock as "unknown" if sufficient trend information was not available or could not be used to assess stock status." WDFW further states that, "[s]tocks rated as unknown may be rated as healthy, depressed, critical, or extinct once more information is available."

Columbia River DPS – The Service recognizes 141 sub-populations of bull trout in the Columbia River DPS within Idaho, Montana, Oregon, and Washington with additional sub-populations in British Columbia. Of these sub-populations, approximately 79 percent are unlikely to be reestablished if extirpated and 50 percent are at risk of extirpation from naturally occurring events due to their depressed status (USDI 1998a). Many of the remaining bull trout occur as isolated sub-populations in headwater tributaries, or in tributaries where the migratory corridors have been lost or restricted. Few bull trout sub-populations are considered "strong" in terms of relative abundance and sub-population stability. Those few remaining strongholds are generally associated with large areas of contiguous habitats such as portions of the Snake River Basin in Central Idaho, the Upper Flathead Rivers in Montana, and the Blue Mountains in Washington and Oregon. The listing rule characterizes the Columbia River DPS as generally occurring as isolated sub-populations, without a migratory life form to maintain the biological cohesiveness of the sub-populations, and with trends in abundance declining or of unknown status.

Extensive habitat loss and fragmentation of sub-populations have been documented for bull trout in the Columbia River basin and elsewhere within its range (Rieman and McIntyre 1993). Reductions in the amount of riparian vegetation and road construction in the Columbia River basin due to timber harvest, grazing, and agricultural practices have contributed to habitat degradation through elevated stream temperatures, increased sedimentation, and channel embeddedness. Mining activities have compromised habitat conditions by discharging waste materials into streams and diverting and altering stream channels. Residential development has threatened water quality by introducing domestic sewage and altering riparian conditions. Dams of all sizes (i.e., mainstem hydropower and tributary irrigation diversions) have severely limited migration of bull trout in the Columbia River basin. Competition from non-native trout (USDI 1998a) is also considered a threat to bull trout.

Generally, where status is known and population data exist, bull trout populations in the Columbia River DPS are declining (Thomas 1992; Pratt and Huston 199;, Schill 1992). Bull trout in the Columbia River basin occupy about 45 percent of their estimated historic range (Quigley and Arbelbide 1997). Quigley and Arbelbide (1997) considered bull trout populations strong in only 13 percent of the occupied range in the interior Columbia River basin. Rieman et al. (1997) estimated that populations were strong in 6 to 24 percent of the subwatersheds in the entire Columbia River basin.

Coastal/Puget Sound DPS – The Service has identified 34[1] subpopulations of native char (bull trout and/or Dolly Varden) within the Coastal/Puget Sound DPS. These subpopulations were grouped into five analysis areas based on their geographic location: Coastal, Strait of Juan de Fuca, Hood Canal, Puget Sound, and Transboundary. These groupings were made in order to identify trends that may be specific to certain geographic areas. In subpopulations where it is not known if the native char that occur there are bull trout, Dolly Varden or both, they are addressed together as “native char” in this discussion. This does not imply that both exist within a subpopulation when the words “native char” are used, but merely that the subpopulation of char has not been positively identified as bull trout and/or Dolly Varden.

Genetic analysis has been conducted on nine of the 34 native char subpopulations. Samples from five of the nine subpopulations were determined to contain only bull trout (Green River, Queets River, Upper Elwha River, Cushman Reservoir and Lower Skagit River). Two were determined to contain only Dolly Varden (Canyon Creek and Upper Sol Duc River). The Upper Quinault River contained both bull trout and Dolly Varden. No samples had evidence of hybridization.

Within the Coastal/Puget Sound DPS, 12 of the 34 native char subpopulations are known to contain bull trout based on either genetic or morphometric measurement data. In seven of these 12 subpopulations, Dolly Varden are also believed to be present. In three out of the remaining 22 subpopulations, only Dolly Varden are currently known to be present. It should be noted that in most cases, identification was based on a limited number of samples, so it is possible that bull trout may also occur in the three subpopulations that to date, have only yielded Dolly Varden. The Service believes that the current identification trend of subpopulations within the Coastal/Puget Sound population segment indicates the high likelihood of bull trout being present in the majority of remaining subpopulations.

Within the Coastal/Puget Sound distinct population segment, 4 of the 34 delineated native char subpopulations are rated as “healthy” by WDFW, and the remaining 31 are of “unknown” status. Native char subpopulations rated as “healthy” by WDFW are: 1) Queets River; 2) Upper Dungeness River; 3) Cushman Reservoir on the Skokomish River; and, 4) the Lower Skagit River. Currently, all but the Upper Dungeness River subpopulation have been determined to consist of bull trout. The Service believes that the “healthy” status designation for the Queets River, Cushman Reservoir, and Upper Dungeness River subpopulations is not appropriate. Because of information indicating recent declines in the Cushman Reservoir subpopulation (WDFW 1998) and the lack of recent information for the Queets River subpopulation (general decline indicated by fish/day seining data between 1977 and 1991, and no trend information for 1991 to 1997) (WDFW 1998), an “unknown” rating better describes their status. The Upper Dungeness River subpopulation status is “tentatively considered healthy” by WDFW based on a single distributional and abundance survey conducted in 1996 (WDFW 1998).

2. **Lost River Sucker *(Deltistes luxatus)***
The only species in the genus *Deltistes*, the Lost River sucker is native to Upper Klamath Lake and its tributaries. This sucker also historically inhabited the Lost River watershed, Tule Lake, Lower Klamath Lake, and Sheepy Lake (Moyle 1976), but is not considered native to the Klamath River, although it is now found there, at least downstream to Copco Reservoir (Beak 1987). The Lost River sucker is a large sucker

that may reach over 0.9 m (3 ft). It is characterized by a long, slender head with a sub terminal mouth and long, rounded snout. The coloring is dark on the back and sides, fading to white or yellow on the belly. Early records from the Upper Klamath River Basin indicate that the Lost River sucker was common and abundant. Gilbert (1898) noted that the Lost River sucker was "the most important food-fish of the Klamath Lake region". Several commercial operations processed "enormous amounts" of suckers into oil, dried fish, canned fish, and other products (Andreasen 1975; Howe 1968). Currently, less than 75,000 acres of wetlands remain in the Basin (USDI 1992). The majority of the population occurs in Upper Klamath Lake, with a few in J.C. Boyle Reservoir and Copco Reservoir. The Lost River sucker was listed as endangered by the U.S. Fish and Wildlife Service in 1988 (USDI 1988). Critical habitat has not been designated. They are primarily deep lake and impoundment residents that spawn in associated rivers, streams, or springs, including the Williamson and Sprague Rivers. They spawn in swift stretches with rubble or compacted cobble substrate, preferentially on loose gravel when available. They also spawn along the shore of Upper Klamath Lake (e.g., at spring inflows). Spawning has been observed between April and early May.

After hatching, larval suckers migrate out of spawning substrates, which are usually gravels or cobbles, and drift downstream into lakes. Vegetated river and lake shoreline habitats are known to be important during larval and juvenile rearing (Klamath Tribe 1991; Markle and Simon 1993). The Lost River sucker is an omnivorous bottom feeder whose diet includes detritus, zooplankton, algae and aquatic insects (Buettner and Scoppettone 1990). Sexual maturity for Lost River suckers sampled in Upper Klamath Lake occurs between the ages of 6 to 14 years with most maturing at age 9.

3. **Shortnose Sucker *(Chasmistes brevirostris)***

The shortnose sucker is characterized by a terminal mouth with thin lips having weak or no papillae. It historically occurred in Upper Klamath Lake and its tributaries (Miller and Smith 1981). Its historic range likely included Lake of the Woods, Oregon, and probably the Lost River system (Scoppettone and Vinyard 1991). Early records from the Upper Klamath River Basin indicate that the shortnose suckers were common and abundant. Several commercial operations processed "enormous amounts" of suckers into oil, dried fish, canned fish, and other products (Andreasen 1975; Howe 1968). The current distribution of the shortnose sucker includes Upper Klamath Lake and its tributaries, Klamath River downstream to Iron Gate Reservoir, Clear Lake Reservoir and its tributaries, Gerber Reservoir and its tributaries, the Lost River, and Tule Lake. Gerber Reservoir represents the only habitat with a shortnose sucker population that does not also have a Lost River sucker population.

The shortnose sucker was listed as endangered by the U.S. Fish and Wildlife Service in 1988 (USDI 1988). Critical habitat has not been designated. The shortnose sucker is primarily a lake resident that spawns in associated rivers, streams, or springs. Individuals in spawning condition occur in swift current over gravel and rubble bottom (Lee et al. 1980). Spawning runs have been observed from mid-April to mid-May. After hatching, larval suckers migrate out of spawning substrates, which are usually gravels or cobbles, and drift downstream into lakes. Vegetated river and lake shoreline habitats are known to be important during larval and juvenile rearing (Klamath Tribe 1991; Markle and Simon 1993). They are omnivorous bottom feeders whose diets include detritus, zooplankton, algae and aquatic insects (Buettner and Scoppettone 1990). Most shortnose suckers reach sexual maturity at age 6 or 7 (Buettner and Scoppettone 1990). Additionally, this species appears not as tolerant of high pH levels as are other native Klamath Basin fishes (Falter and Cech 1991).

4. **Warner Sucker (*Catostomus warnerensis*)**
The Warner sucker occurs in water bodies within the Warner Basin of south-central Oregon. This species is in decline due to modifications of the native habitat and was federally listed as threatened in September 1985. Critical habitat was designated at that time (USDI 1985). Critical habitat includes the following areas: Twenty mile Creek from the confluence of Twelve mile and Twenty mile Creeks upstream for about 4 stream miles; Twenty mile Creek starting about 9 miles upstream of the junction of Twelve mile and Twenty mile Creeks and extending downstream about 18 miles; Spillway Canal north of Hart Lake and continuing about 2 miles downstream; Snyder Creek, from the confluence of Snyder and Honey Creeks upstream for about 3 miles; Honey Creek, from the confluence Hart Lake upstream for about 16 miles. The probable historic range of the Warner sucker includes the main Warner Lakes (Pelican, Crump, and Hart), and other accessible standing or flowing water in the Warner Valley, including the low to moderate gradient reaches of the tributaries which drain into the basin. These tributaries include Deep Creek, the Honey Creek drainage, Snyder Creek and the Twenty mile Creek drainage, including Greaser Reservoir (White et al. 1990).

The Warner sucker currently inhabits the lakes and low gradient stream reaches of the Warner Valley, and is represented by a larger lake morph and a smaller stream morph. Studies have shown that when adequate water is present, Warner suckers may inhabit all the lakes, sloughs, and potholes in the Warner Valley. The species is also known to occur in large irrigation canals. The documented range of the sucker extended as far north into the ephemeral Flagstaff Lake during high water in the early 1980's, and again in the 1990's (Allen et al. 1996). The larger, presumably longer-lived, lake morphs are capable of surviving through several continuous years of isolation from stream spawning habitats due to drought or other factors. Similarly, stream morphs probably serve as sources for recolonization of lake habitats in wet years following droughts. The loss of either lake or stream morphs to drought, winterkill, excessive flows and a flushing of the fish in a stream, in conjunction with the lack of safe migration routes and the presence of predaceous exotic fishes, may strain the ability of the species to rebound (White et al. 1990; Berg 1991).

Warner sucker larvae have terminal mouths and short digestive tracts, enabling them to feed selectively in midwater or on the surface. Invertebrates, particularly planktonic crustaceans, make up most of their diet. As the suckers grow, they develop subterminal mouths, longer digestive tracts, and gradually become generalized benthic feeders of diatoms, filamentous algae, and detritus. Adult stream morph suckers forage nocturnally over a wide variety of substrates such as boulders, gravel, and silt. Adult lake morph suckers are thought to have a similar diet, but feed over predominantly muddy substrates (Tait and Mulkey 1993a, b).

Sexual maturity occurs at an age of 3 to 4 years (Coombs et al. 1979). Spawning usually occurs in April and May when fish migrate up streams, although variations in water temperature and stream flow may result in either earlier or later spawning. Temperature and flow cues appear to trigger spawning, with most spawning taking place at 14-20°C (57-68°F) when stream flows are relatively high. The Warner sucker spawns in sand or gravel beds in slow pools (White et al. 1990, 1991; Kennedy and North 1993). In years when access to stream spawning areas is limited by low flow or by physical in-stream blockages (such as beaver dams or diversion structures), suckers may attempt to spawn on gravel beds along the lake shorelines. Larvae are found in shallow backwater pools or on stream margins where there is no current, often among or near macrophytes. Young of the year are often found over deep, still water from midwater to the surface, but also move into faster flowing areas near the heads of pools (Coombs et al. 1979). Juveniles (1 to 2 years old) are usually found at the bottom of deep pools or in other habitats that are relatively cool and permanent such as near springs and like adults, prefer areas that are protected from the main flows. It has been suggested that juveniles do not migrate down from streams until 2 to 3 years of age (Coombs et al. 1979).

Adult suckers in streams prefer long pools with undercut banks, containing high macrophytic coverage of substrates (>70%) and root wads or large boulders, with a maximum depth of 1.5 meters (5 ft), a 2°C (35.6'F) differential between the surface and the pool bottom, and overhanging vegetation (often Salix sp.). Suckers were also found in smaller and shallower pools lacking some of the above mentioned characteristics but only when a larger pool was within close proximity (-0.4km) (USDI 1997b). Habitat use by suckers in lakes resembles that of stream residents and adults are generally found in the deepest available habitat where food is plentiful (USDI 1997b).

5. **Chinook Salmon (*Onchorhynchus tshawytscha*)**

Chinook salmon in streams and rivers are generally divided into two races: spring and fall run Chinook salmon. Spring Chinook enter freshwater from April though June are usually associated with larger rivers and streams that have adequate summer flows and deep resting pools for adults during the summer. Fall Chinook enter freshwater from September through December and use many of the medium-sized and larger streams with access from the ocean through low gradient stream habitat. Their annual spawning distribution in smaller streams is dependent on the amount of fall rains and resultant streamflow.

Spring Chinook spawn in the early fall, earlier than fall Chinook in most rivers. Fall Chinook spawn from early fall to mid-winter. Chinook salmon are semelparous and die after spawning. Chinook fry emerge in late winter to early spring and typically begin a downstream migration to the river estuary or the ocean. Variations from this occur in all populations with some fry remaining in freshwater for a year. Chinook salmon fry and parr generally rear in larger streams and rivers. The typical life cycle for Chinook salmon is to spend a few months in freshwater and two to five years in saltwater and thus they are ocean rearing. Many variations occur in the freshwater rearing timing, and precocious males return from the ocean a year or two early as jacks.

a. **Lower Columbia River Chinook Salmon -** The lower Columbia River is characterized by numerous short- and medium-length rivers that drain the coast ranges and the west slope of the Cascade Mountains. The LCR Chinook salmon ESU includes all native populations from the mouth of the Columbia River to the crest of the Cascade Range, excluding populations above Willamette Falls. The former location of Celilo Falls (inundated by The Dalles reservoir in 1960) is the eastern boundary for this ESU. Stream-type, spring-run Chinook salmon found in the Klickitat River or the introduced Carson spring-run Chinook salmon strain is not included in this ESU. Spring-run Chinook salmon in the Sandy River have been influenced by spring-run Chinook salmon introduced from the Willamette River ESU. However, analyses suggest that considerable genetic resources still reside in the existing population (Myers et al. 1998). Recent escapements above Marmot Dam on the Sandy River average 2,800 and have been increasing (ODFW 1998). Tule fall Chinook from the LCR Chinook salmon ESU were observed spawning in the Ives Island area during October 1999. The Hardy/Hamilton Creeks/Ives Island complex is located along the Washington shoreline approximately 2 miles below Bonneville Dam.

   Historical records of Chinook salmon abundance are sparse, but cannery records suggest a peak run of 4.6 million fish in 1883. Although fall-run Chinook salmon are still present throughout much of their historical range, most of the fish spawning today are first-generation hatchery strays. Furthermore, spring-run populations have been severely depleted throughout the ESU and extirpated from several rivers.

   Most fall-run fish in the LCR Chinook salmon ESU emigrate to the marine environment as sub yearlings (Reimers and Loeffel 1967; Howell et al. 1985; WDF et al. 1993). Returning adults that emigrated as yearling smolts may have originated from the extensive hatchery programs in the ESU. It is also possible that modifications in the river environment have altered the duration of freshwater residence. Coded-wire tag (CWT) recoveries of LCR Chinook salmon ESU fish suggest a northerly migration route, but (based on CWT recoveries) the fish contribute more to fisheries off British Columbia and Washington than to the Alaskan fishery. Tule fall Chinook salmon return at adult ages 3 and 4; “bright” fall Chinook return at ages 4 and 5, with significant numbers returning at age 6. Tule and bright Chinook salmon are distinct in their spawn timing.

   As in other ESUs, Chinook salmon have been affected by the alteration of freshwater habitat (Bottom et al. 1984; WDF et al. 1993; Kostow 1995). Timber harvesting and associated road building peaked in the 1930s, but effects from the timber industry remain (Kostow 1995). Agriculture is widespread in this ESU and has affected riparian vegetation and stream hydrology. The ESU is also highly affected by urbanization, including river diking and channelization, wetland draining and filling, and pollution (Kostow 1995).

The LCR Chinook salmon ESU has been subject to intensive hatchery influence. Hatchery programs to enhance Chinook salmon fisheries in the lower Columbia River began in the 1870s, releasing billions of fish over time. That equals the total hatchery releases for all other Chinook ESUs combined (Myers et al. 1998). Although most of the stocks have come from inside the ESU, more than 200 million fish from outside the ESU have been released since 1930 (Myers et al. 1998).

For the LCR Chinook salmon ESU as a whole, NMFS estimates that the median population growth rate (lambda) over the base period ranges from 0.98 to 0.88, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (Tables B-2a and B-2b in McClure et al. 2000).

b. **Upper Columbia River Spring-Run Chinook Salmon -** This ESU includes spring-run Chinook populations found in Columbia River tributaries between Rock Island and Chief Joseph Dams, notably the Wenatchee, Entiat, and Methow River Basins. The populations are genetically and ecologically separate from the summer- and fall-run populations in the lower parts of many of the same river systems (Myers et al. 1998). Although fish in this ESU are genetically similar to spring Chinook in adjacent ESUs (i.e., mid-Columbia and Snake), they are distinguished by ecological differences in spawning and rearing habitat preferences. For example, spring-run Chinook in upper Columbia River tributaries spawn at lower elevations (500 to 1,000 m) than in the Snake and John Day River systems.

The upper Columbia River populations were intermixed during the Grand Coulee Fish Maintenance Project (1939 through 1943), resulting in loss of genetic diversity between populations in the ESU. Homogenization remains an important feature of the ESU. Fish abundance has trended downward both recently and over the long term. At least six former populations from this ESU are now extinct, and nearly all extant populations have fewer than 100 wild spawners.

UCR spring-run Chinook are considered stream-type fish, with smolts migrating as yearlings. Most stream-type fish mature at 4 years of age. Few CWTs are recovered in ocean fisheries, suggesting that the fish move quickly out of the north central Pacific and do not migrate along the coast.

Spawning and rearing habitat in the Columbia River and its tributaries upstream of the Yakima River includes dry areas where conditions are less conducive to steelhead survival than in many other parts of the Columbia Basin (Mullan et al. 1992). Salmon in this ESU must pass up to nine Federal and private dams, and Chief Joseph Dam prevents access to historical spawning grounds farther upstream. Degradation of remaining spawning and rearing habitat continues to be a major concern associated with urbanization, irrigation projects, and livestock grazing along riparian corridors. Overall harvest rates are low for this ESU, currently less than 10 percent (ODFW and WDFW 1995).

Spring-run Chinook salmon from the Carson National Fish Hatchery (a large composite, non- native stock) were introduced into, and have been released from, local hatcheries (Leavenworth, Entiat, and Winthrop National Fish Hatcheries [NFH]). Little evidence suggests that these hatchery fish stray into wild areas or hybridize with naturally spawning populations. In addition to these national production hatcheries, two supplementation hatcheries are operated by the WDFW in this ESU. The Methow Fish Hatchery Complex (operations began in 1992) and the Rock Island Fish Hatchery Complex (operations began in 1989) were both designed to implement supplementation programs for naturally spawning populations on the Methow and Wenatchee Rivers, respectively (Chapman et al. 1995).

For the UCR spring-run Chinook salmon ESU as a whole, NMFS estimates that the median population growth rate (lambda) over the base period ranges from 0.85 to 0.83, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (Tables B-2a and B-2b in McClure et al. 2000). NMFS used population risk assessments for UCR spring-run Chinook salmon and steelhead ESUs from the draft quantitative analysis report (QAR) (Cooney 2000). Risk assessments described in that report were based on Monte Carlo simulations with simple spawner/spawner models that incorporate estimated smolt carrying capacity. Population dynamics were simulated for three separate spawning populations in the UCR spring-run Chinook salmon ESU, the Wenatchee, Entiat, and Methow populations. The QAR assessments showed extinction risks for UCR spring Chinook salmon of 50 percent for the Methow, 98 percent for the Wenatchee, and 99 percent for the Entiat spawning populations. These estimates are based on the assumption that the median return rate for the 1980 brood year to the 1994 brood year series will continue into the future.

c. **Puget Sound Chinook Salmon** (Provided by NOAA Fisheries, Portland, Oregon) The Puget Sound chinook salmon was listed as a threatened under the Endangered Species Act (ESA) on March 24, 1999. The ESU includes all naturally spawned populations of chinook salmon from rivers and streams flowing into Puget Sound including the Straits of Juan De Fuca from the Elwha River, eastward, including rivers and streams flowing into Hood Canal, South Sound, North Sound and the Strait of Georgia in Washington. Chinook salmon (and their progeny) from the following hatchery stocks are considered part of the listed ESU: Kendall Creek (spring run); North Fork Stillaguamish River (summer run); White River (spring run); Dungeness River (spring run); and Elwha River (fall run).

The Skagit River and its tributaries--the Baker, Sauk, Suiattle, and Cascade Rivers--constitute what was historically the predominant system in Puget Sound containing naturally spawning populations. Spring-run chinook salmon are present in the North and South Fork Nooksack Rivers, the Skagit River Basin, the White, and the Dungeness Rivers. Spring-run populations in the Stillaguamish, Skokomish, Dosewallips, and Elwha Rivers are thought to be extinct. Summer-run chinook salmon are present in the Upper Skagit and Lower Sauk Rivers in addition to the Stilliguamish and Snohomish Rivers. Fall-run stocks (also identified by management agencies as summer/fall runs in Puget Sound) are found throughout the region in all major river systems. Adult spring-run chinook salmon in the Puget Sound typically return to freshwater in April and May and spawn in August and September. Adults migrate to the upper portions of their respective river systems and hold in pools until they mature. In contrast, summer-run fish begin their freshwater migration in June and July and spawn in September, while summer/fall-run chinook salmon begin to return in August and spawn from late September through January.

The majority of Puget Sound fish emigrate to the ocean as subyearlings. Many of the rivers have well-developed estuaries that are important rearing areas for emigrating ocean-type smolts. In contrast, the Suiattle and South Fork Nooksack Rivers have been characterized as producing a majority of yearling smolts. The reason for this difference is unknown. Glacially influenced conditions on the Suiattle River may be responsible for limiting juvenile growth, delaying smolting, and producing a higher proportion of 4- and 5-year-olds compared to other chinook salmon stocks in Puget Sound, which mature predominantly as 3- and 4-year-olds.

Anthropogenic activities have limited the access to historical spawning grounds and altered downstream flow and thermal conditions. Water diversion and hydroelectric dams have prevented access to portions of several rivers. Furthermore, the construction of Cushman Dam on the North Fork Skokomish River may have resulted in a residualized population of chinook salmon in Lake Cushman. Watershed development and activities throughout Puget Sound, Hood Canal, and Strait of Juan de Fuca regions have resulted in increased sedimentation, higher water temperatures, decreased large woody debris (LWD) recruitment, decreased gravel recruitment, a reduction in river pools and spawning areas, and a loss of estuarine rearing areas.

Overall abundance of chinook salmon in this ESU has declined substantially from historical levels, and many populations are small enough that genetic and demographic risks are likely to be relatively high. Contributing to these reduced abundances are widespread stream blockages, which reduce access to spawning habitat, especially in upper reaches. Both long- and short-term trends in abundance are predominantly downward, and several populations are exhibiting severe short-term declines. Spring-run chinook salmon populations throughout this ESU are all depressed.

d. **Snake River Fall-Run Chinook Salmon**. - The Snake Basin drains an area of approximately 280,000 km^2 and incorporates a range of vegetative life zones, climatic regions, and geological formations, including the deepest canyon (Hells Canyon) in North America. The ESU includes the mainstem river and all tributaries, from their confluence with the Columbia River to the Hells Canyon Dam complex. Because genetic analyses indicate that fall-run Chinook salmon in the Snake River are distinct from the spring/summer-run in the Snake River Basin (Waples et al. 1991), SR fall-run Chinook salmon is considered separately from the other two forms. They are also considered separately from those assigned to the UCR summer- and fall-run ESU because of considerable differences in habitat characteristics and adult ocean distribution and less definitive, but still significant, genetic differences. There is, however, some concern that recent introgression from Columbia River hatchery strays is causing the Snake River population to lose the qualities that made it distinct for ESA purposes.

SR fall-run Chinook salmon remained stable at high levels of abundance through the first part of the twentieth century, but then declined substantially. Although the historical abundance of fall- run Chinook salmon in the Snake River is difficult to estimate, adult returns appear to have declined by three orders of magnitude since the 1940s, and perhaps by another order of magnitude from pristine levels. Irving and Bjornn (1981) estimated that the mean number of fall-run Chinook salmon returning to the Snake River declined from 72,000 during the period 1938 to 1949 to 29,000 during the 1950s. Further declines occurred upon completion of the Hells Canyon Dam complex, which blocked access to primary production areas in the late 1950s (see below).

Fall-run Chinook salmon in this ESU are ocean-type. Adults return to the Snake River at ages 2 through 5, with age 4 most common at spawning (Chapman et al. 1991). Spawning, which takes place in late fall, occurs in the mainstem and in the lower parts of major tributaries (NWPPC 1989; Bugert et al. 1990). Juvenile fall-run Chinook salmon move seaward slowly as sub yearlings, typically within several weeks of emergence (Chapman et al. 1991). Based on modeling by the Chinook Technical Committee, the Pacific Salmon Commission estimates that a significant proportion of the SR fall-run Chinook (about 36 percent) are taken in Alaska and Canada, indicating a far-ranging ocean distribution. In recent years, only 19 percent were caught off Washington, Oregon, and California, with the balance (45 percent) taken in the Columbia River (Simmons 2000).

With hydrosystem development, the most productive areas of the Snake River Basin are now inaccessible or inundated. The upper reaches of the mainstem Snake River were the primary areas used by fall-run Chinook salmon, with only limited spawning activity reported downstream from river kilometer (Rkm) 439. The construction of Brownlee Dam (1958; Rkm 459), Oxbow Dam (1961; Rkm 439), and Hells Canyon Dam (1967; Rkm 397) eliminated the primary production areas of SR fall-run Chinook salmon. There are now 12 dams on the mainstem Snake River, and they have substantially reduced the distribution and abundance of fall-run Chinook salmon (Irving and Bjornn 1981).

The Snake River has contained hatchery-reared fall-run Chinook salmon since 1981 (Busack 1991). The hatchery contribution to Snake River escapement has been estimated at greater than 47 percent (Myers et al. 1998). Artificial propagation is recent, so cumulative genetic changes associated with it may be limited. Wild fish are incorporated into the brood stock each year, which should reduce divergence from the wild population. Release of sub yearling fish may also help minimize the differences in mortality patterns between hatchery and wild populations that can lead to genetic change (Waples 1999).

Some SR fall-run Chinook historically migrated over 1,500 km from the ocean. Although the Snake River population is now restricted to habitat in the lower river, genes associated with the lengthier migration may still reside in the population. Because longer freshwater migrations in Chinook salmon tend to be associated with more-extensive oceanic migrations (Healey 1983), maintaining populations occupying habitat that is well inland may be important in continuing diversity in the marine ecosystem as well.

For the SR fall-run Chinook salmon ESU as a whole, NMFS estimates that the median population growth rate (lambda) over the base period[20] ranges from 0.94 to 0.86, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (Tables B-2a and B-2b in McClure et al. 2000).

e. **Snake River Spring/Summer-Run Chinook Salmon -** The location, geology, and climate of the Snake River region create a unique aquatic ecosystem for Chinook salmon. Spring-run and/or summer-run Chinook salmon are found in several sub-basins of the Snake River (CBFWA 1990). Of these, the Grande Ronde and Salmon Rivers are large, complex systems composed of several smaller tributaries that are further composed of many small streams. In contrast, the Tucannon and Imnaha Rivers are small systems with most salmon production in the main river. In addition to these major sub-basins, three small streams (Asotin, Granite, and Sheep Creeks) that enter the Snake River between Lower Granite and Hells Canyon Dams provide small spawning and rearing areas (CBFWA 1990). Although there are some indications that multiple ESUs may exist within the Snake River Basin, the available data do not clearly demonstrate their existence or define their boundaries. Because of compelling genetic and life-history evidence that fall-run Chinook salmon are distinct from other Chinook salmon in the Snake River, however, they are considered a separate ESU.

Historically, spring and/or summer-run Chinook salmon spawned in virtually all accessible and suitable habitats in the Snake River system (Evermann 1895; Fulton 1968). During the late 1800s, the Snake River produced a substantial fraction of all Columbia Basin spring and summer Chinook salmon, with total production probably exceeding 1.5 million in some years. By the mid-1900s, the abundance of adult spring and summer Chinook salmon had greatly declined. Fulton (1968) estimated that an average of 125,000 adults per year entered the Snake River tributaries from 1950 through 1960. As evidenced by adult counts at dams, however, spring and summer Chinook salmon has declined considerably since the 1960s.

In the Snake River, spring and summer Chinook share key life history traits. Both are stream-type fish, with juveniles that migrate swiftly to sea as yearling smolts. Depending primarily on location within the basin (and not on run type), adults tend to return after either 2 or 3 years in the ocean. Both spawn and rear in small, high-elevation streams (Chapman et al. 1991), although where the two forms coexist, spring-run Chinook spawn earlier and at higher elevations than summer-run Chinook.

Even before mainstem dams were built, habitat was lost or severely damaged in small tributaries by construction and operation of irrigation dams and diversions, inundation of spawning areas by impoundments, and siltation and pollution from sewage, farming, logging, and mining (Fulton 1968). Recently, the construction of hydroelectric and water storage dams without adequate provision for adult and juvenile passage in the upper Snake River has kept fish from all spawning areas upstream of Hells Canyon Dam.

There is a long history of human efforts to enhance production of Chinook salmon in the Snake River Basin through supplementation and stock transfers. The evidence is mixed as to whether these efforts have altered the genetic makeup of indigenous populations. Straying rates appear to be very low.

For the SR spring/summer-run Chinook salmon ESU as a whole, NMFS estimates that the median population growth rate (lambda) over the base period 1 ranges from 0.96 to 0.80, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to the effectiveness of fish of wild origin (Tables B-2a and B-2b in McClure et al. 2000).

6. **Columbia River Chum Salmon (*Onchorhynchus keta*)**

Chum salmon of the Columbia River ESU spawn in tributaries and in mainstem areas below Bonneville Dam. Most fish spawn on the Washington side of the Columbia River (Johnson et al. 1997). Previously, chum salmon were reported in almost every river in the lower Columbia River Basin, but most runs disappeared by the 1950s (Rich 1942; Marr 1943; Fulton 1970). Currently, WDFW regularly monitors only a few natural populations in the basin, one in Grays River, two in small streams near Bonneville Dam, and the mainstem area next to one of the latter two streams. Recently spawning has occurred in the mainstem Columbia River at two spots near Vancouver, Washington and in Duncan Creek below Bonneville Dam.

Chum salmon enter the Columbia River from mid-October through early December and spawn from early November to late December. Recent genetic analysis of fish from Hardy and Hamilton Creeks and from the Grays River indicates that these fish are genetically distinct from other chum salmon populations in Washington. Genetic variability within and between populations in several geographic areas is similar, and populations in Washington show levels of genetic subdivision typical of those seen between summer- and fall-run populations in other areas and typical of populations within run types (Salo 1991; Phelps et al. 1994; Johnson et al. 1997).

Historically, the CR chum salmon ESU supported a large commercial fishery, landing more than 500,000 fish per year. Commercial catches declined beginning in the mid-1950s. There are now no recreational or directed commercial fisheries for chum salmon in the Columbia River, although chum salmon are taken incidentally in the gill-net fisheries for coho and Chinook salmon, and some tributaries have a minor recreational harvest.

Hatchery fish have had little influence on the wild component of the CR chum salmon ESU. NMFS estimates a median population growth rate (lambda) over the base period, for the ESU as a whole, of 1.04 (Tables B-2a and B-2b in McClure et al. 2000). Because census data are peak counts (and because the precision of those counts decreases markedly during the spawning season as water levels and turbidity rise), NMFS is unable to estimate the risk of absolute extinction for this ESU.

7. **Hood Canal Summer-Run Chum Salmon (*Onchorhynchus keta*)**
Text Provided by NOAA Fisheries, Portland, Oregon. Hood Canal chum salmon were listed as a threatened species under the Endangered Species Act (ESA) on March 25, 1999. The ESU includes all naturally spawned populations of summer-run chum salmon in Hood Canal and it tributaries as well as populations in Olympic Peninsula rivers between Hood Canal and Dungeness Bay, Washington

Hood Canal summer-run chum salmon are defined as fish that spawn from mid-September to mid-October. Fall-run chum salmon are defined as fish that spawn from November through December or January. Run-timing data from as early as 1913 indicated temporal separation between summer and fall chum salmon in Hood Canal. Even though for many years there have been hatchery releases of fall chum salmon in Hood Canal and many of these fish return to hatcheries in Hood Canal and were historically spawned before the end of October, recent spawning surveys show that temporal separation still exists between summer and fall chum salmon. Genetic data indicate strong and long-standing reproductive isolation between chum salmon in this ESU and other chum salmon populations in the United States and British Columbia. Hood Canal is also geographically separated from other areas of Puget Sound, the Strait of Georgia, and the Pacific Coast.

In general, summer-run chum salmon are most abundant in the northern part of the species' range, where they spawn in the main stems of rivers. Farther south, water temperatures are so high and stream flows are often so low during late summer and early fall that conditions become unfavorable for salmonids. River flows typically do not increase and water temperatures do not decrease until the arrival of fall rains in late October/November. Presumably for these reasons, few summer chum populations are recognized south of northern British Columbia. Ecologically, summer-run chum salmon populations from Washington must return to freshwater and spawn during peak periods of high water temperature, suggesting an adaptation to specialized environmental conditions that allow this life-history strategy to persist in an otherwise inhospitable environment.

Some chum salmon populations in the Puget Sound/Strait of Georgia ESU, which has four recognized summer-run populations and two recognized winter-run populations, also exhibit unusual run timing. However, allozyme data indicate that these populations are genetically closely linked to nearby fall-run populations. Therefore, variation in run timing has presumably evolved more than once in the southern part of the species' range. Genetic data indicate that summer-run populations from Hood Canal and the

Strait of Juan de Fuca are part of a much more ancient lineage than summer-run chum salmon in southern Puget Sound.

Although summer chum salmon in this ESU have experienced a continuing decline over the past 30 years, escapement in 1995-96 increased dramatically in some streams. These increases in escapement were observed primarily in rivers on the west side of Hood Canal, with the largest increase in the Big Quilcene River where the USFWS has been conducting an enhancement program starting with the 1992 brood year. Streams on the east side of Hood Canal continued either to have no returning adults (Big Beef Creek, Anderson Creek, and the Dewatto River) or no increases in escapement.

8. **Steelhead (*Onchorhynchus mykiss*)**

Steelhead trout are rainbow trout that migrate to the ocean. Two races of steelhead are found: summer and winter steelhead. Summer steelhead are usually associated with larger rivers that have adequate summer flows to accommodate summer upstream migration and deep resting pools with cooler water. Summer steelhead are generally found in rivers with spring Chinook populations. Summer steelhead tend to spawn in very small, intermittent tributaries and winter steelhead tend to spawn in medium to large streams. Steelhead exhibit a wide variety of migration and freshwater rearing strategies, and spawn from mid-winter to late spring. Summer steelhead fry tend to emerge earlier in the late winter/early spring than winter steelhead fry. Historic steelhead habitat is extremely variable as these fish are adept at migrating through steep gradient stream segments and over waterfalls of moderate height. Steelhead trout fry and parr can be found in very steep mountain stream habitat and in interior and coastal unconstrained valley streams.

Generally, steelhead remain in freshwater for one to three years and the ocean phase varies from one to three years. Steelhead trout are oviparous and can return to spawn more than once. Ocean migration is highly variable for steelhead trout, generally following the north and south migration strategies of coho salmon and Chinook salmon previously discussed. Steelhead are less gregarious than salmon in their ocean phase and individuals can range as far as offshore of the Aleutian Island area.

a. **Lower Columbia River Steelhead -** The Lower Columbia River ESU encompasses all steelhead runs in tributaries between the Cowlitz and Wind Rivers on the Washington side of the Columbia River, and the Willamette and Hood Rivers on the Oregon side. The populations of steelhead that make up the Lower Columbia River ESU are distinguished from adjacent populations by genetic and habitat characteristics. The ESU consists of summer and winter coastal steelhead runs in the tributaries of the Columbia River as it cuts through the Cascades. These populations are genetically distinct from inland populations (east of the Cascades), as well as from steelhead populations in the upper Willamette River Basin and coastal runs north and south of the Columbia River mouth. Not included in the ESU are runs in the Willamette River above Willamette Falls (Upper Willamette River ESU), runs in the Little and Big White Salmon rivers (Middle Columbia River ESU) and runs based on four imported hatchery stocks: early-spawning winter Chambers Creek/lower Columbia River mix, summer Skamania Hatchery stock, winter Eagle Creek NFH stock, and winter Clackamas River ODFW stock (63 FR 13351 and 13352). This area has at least 36 distinct runs (Busby et al.

1996), 20 of which were identified in the initial listing petition. In addition, numerous small tributaries have historical reports of fish, but no current abundance data. The major runs in the ESU, for which there are estimates of run size, are the Cowlitz River winter runs, Toutle River winter runs, Kalama River winter and summer runs, Lewis River winter and summer runs, Washougal River winter and summer runs, Wind River summer runs, Clackamas River winter and summer runs, Sandy River winter and summer runs, and Hood River winter and summer runs.

For the larger runs, current counts have been in the range of one to 2,000 fish (Cowlitz, Kalama, and Sandy Rivers); historical counts, however, put these runs at more than 20,000 fish. In general, all runs in the ESU have declined over the past 20 years, with sharp declines in the last 5 years.

Steelhead in this ESU are thought to use estuarine habitats extensively during out migration, smoltification, and spawning migrations. The lower reaches of the Columbia River are highly modified by urbanization and dredging for navigation. The upland areas covered by this ESU are extensively logged, affecting water quality in the smaller streams used primarily by summer runs. In addition, all major tributaries used by LCR steelhead have some form of hydraulic barrier that impedes fish passage. Barriers range from impassible structures in the Sandy Basin that block access to extensive, historically occupied, steelhead habitat, to passable but disruptive projects on the Cowlitz and Lewis Rivers. The Biological Review Team (BRT 1997) viewed the overall effect of hydrosystem activities on this ESU as an important determinant of extinction risk.

Many populations of steelhead in the Lower Columbia River ESU are dominated by hatchery escapement. Roughly 500,000 hatchery-raised steelhead are released into drainages within this ESU each year. As a result, first-generation hatchery fish are thought to make up 50 percent to 80 percent of the fish counted on natural spawning grounds. The effect of hatchery fish is not uniform, however. Several runs are mostly hatchery strays (e.g., the winter run in the Cowlitz River [92 percent] and the Kalama River [77 percent] and the summer run in the North Fork Washougal River [50 percent]), whereas others are almost free of hatchery influence (the summer run in the mainstem Washougal River [0 percent] and the winter runs in the North Fork Toutle and Wind Rivers [0 percent to 1 percent]).

Escapement estimates for the steelhead fishery in the Lower Columbia River ESU are based on in river and estuary sport-fishing reports; there is a limited ocean fishery on this ESU. Harvest rates range from 20 percent to 50 percent on the total run, but for hatchery-wild differentiated stocks, harvest rates on wild fish have dropped to 0 percent to 4 percent in recent years (punch card data from WDFW through 1994).

For the LCR steelhead ESU as a whole, NMFS estimates that the median population growth rate (lambda) over the base period ranges from 0.98 to 0.78, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (Tables B-2a and B-2b in McClure et al. 2000).

b. **Middle Columbia River Steelhead -** The MCR steelhead ESU occupies the Columbia River Basin from above the Wind River in Washington and the Hood River in Oregon and continues upstream to include the Yakima River, Washington. The region includes some of the driest areas of the Pacific Northwest, generally receiving less than 16 inches of precipitation annually (Jackson 1993). Summer steelhead are widespread throughout the ESU; winter steelhead occur in Mosier, Chenowith, Mill, and Fifteenmile creeks, Oregon, and in the Klickitat and White Salmon Rivers, Washington. The John Day River probably represents the largest native, natural spawning stock of steelhead in the region.

Estimates of historical (pre-1960s) abundance specific to this ESU are available for the Yakima River, which has an estimated run size of 100,000 (WDF et al. 1993). Assuming comparable run sizes for other drainage areas in this ESU, the total historical run size may have exceeded 300,000 steelhead.

Most fish in this ESU smolt at 2 years and spend 1 to 2 years in salt water before reentering freshwater, where they may remain up to a year before spawning (Howell et al. 1985). All steelhead upstream of The Dalles Dam are summer-run (Chapman et al. 1994). The Klickitat River, however, produces both summer and winter steelhead, and age-2-ocean steelhead dominate the summer steelhead, whereas most other rivers in the region produce about equal numbers of both age-1- and 2-ocean fish. A nonanadromous form co-occurs with the anadromous form in this ESU; information suggests that the two forms may not be isolated reproductively, except where barriers are involved.

The only substantial habitat blockage now present in this ESU is at Pelton Dam on the Deschutes River, but minor blockages occur throughout the region. Water withdrawals and overgrazing have seriously reduced summer flows in the principal summer steelhead spawning and rearing tributaries of the Deschutes River. This is significant because high summer and low winter temperatures are limiting factors for salmonids in many streams in this region (Bottom et al. 1984).

Continued increases in the proportion of stray steelhead in the Deschutes Basin is a major concern. The ODFW and the Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO) estimate that 60 percent to 80 percent of the naturally spawning population consists of strays, which greatly outnumber naturally produced fish. Although the reproductive success of stray fish has not been evaluated, their numbers are so high that major genetic and ecological effects on natural populations are possible (Busby et al. 1999). The negative effects of any interbreeding between stray and native steelhead will be exacerbated if the stray steelhead originated in geographically distant river basins, especially if the river basins are in different ESUs. The populations of steelhead in the Deschutes Basin include steelhead native to the Deschutes River, hatchery steelhead from the Round Butte Hatchery on the Deschutes River, wild steelhead strays from other rivers in the Columbia Basin, and hatchery steelhead strays from other Columbia Basin streams

Regarding the latter, CTWSRO reports preliminary findings from a tagging study by T. Bjornn and M. Jepson (University of Idaho) and NMFS suggesting that a large fraction of the steelhead passing through Columbia River dams (e.g., John Day and Lower Granite dams) have entered the Deschutes River and then returned to the mainstem Columbia River. A key unresolved question about the large number of strays in the Deschutes basin is how many stray fish remain in the basin and spawn naturally.

For the MCR steelhead ESU as a whole, NMFS estimates that the median population growth rate (lambda) over the base period10 ranges from 0.88 to 0.75, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (Tables B-2a and B-2b in McClure et al. 2000).

c. Upper Columbia River (UCR) Steelhead - The UCR steelhead ESU occupies the Columbia Basin upstream of the Yakima River. Rivers in the area primarily drain the east slope of the northern Cascade Mountains and include the Wenatchee, Entiat, Methow, and Okanogan River basins. The climate of the area reaches temperature and precipitation extremes; most precipitation falls as mountain snow (Mullan et al. 1992). The river valleys are deeply dissected and maintain low gradients, except for the extreme headwaters (Franklin and Dyrness 1973).

Estimates of historical (pre-1960s) abundance specific to this ESU are available from fish counts at dams. Counts at Rock Island Dam from 1933 to 1959 averaged 2,600 to 3,700, suggesting a prefishery run size exceeding 5,000 adults for tributaries above Rock Island Dam (Chapman et al. 1994). Runs may, however, already have been depressed by lower Columbia River fisheries.

As in other inland ESUs (the Snake and mid-Columbia Basins), steelhead in the Upper Columbia River ESU remain in freshwater up to a year before spawning. Smolt age is dominated by 2- year-olds. Based on limited data, steelhead from the Wenatchee and Entiat rivers return to freshwater after 1 year in salt water, whereas Methow River steelhead are primarily age-2-ocean (Howell et al. 1985). Life history characteristics for UCR steelhead are similar to those of other inland steelhead ESUs; however, some of the oldest smolt ages for steelhead, up to 7 years, are reported from this ESU. The relationship between anadromous and nonanadromous forms in the geographic area is unclear.

The Chief Joseph and Grand Coulee Dam construction caused blockages of substantial habitat, as did that of smaller dams on tributary rivers. Habitat issues for this ESU relate mostly to irrigation diversions and hydroelectric dams, as well as to degraded riparian and instream habitat from urbanization and livestock grazing.

Hatchery fish are widespread and escape to spawn naturally throughout the region. Spawning escapement is dominated by hatchery-produced fish.

For the UCR steelhead ESU as a whole, NMFS estimates that the median population growth rate (lambda) over the base period ranges from 0.94 to 0.66, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (Tables B-2a and B-2b in McClure et al. 2000). Because of data limitations, the QAR steelhead assessments in Cooney (2000) were limited to two aggregate spawning groups—the Wenatchee/Entiat composite and the above-Wells populations. Wild production of steelhead above Wells Dam was assumed to be limited to the Methow system. Assuming a relative effectiveness of hatchery spawners of 1.0, the risk of absolute extinction within 100 years for UCR steelhead is 100 percent. The QAR also assumed hatchery effectiveness values of 0.25 and 0.75. A hatchery effectiveness of 0.25 resulted in projected risks of extinction of 35 percent for the Wenatchee/Entiat and 28 percent for the Methow populations. At a hatchery effectiveness of 0.75, risks of 100 percent were projected for both populations.

d. Snake River Basin Steelhead. - Steelhead spawning habitat in the Snake River is distinctive in having large areas of open, low-relief streams at high elevations. In many Snake River tributaries, spawning occurs at a higher elevation (up to 2,000 m) than for steelhead in any other geographic region. SR Basin steelhead also migrate farther from the ocean (up to 1,500 km) than most.

No estimates of historical (pre-1960s) abundance specific to this ESU are available.

Fish in this ESU are summer-run steelhead. They enter freshwater from June to October and spawn during the following March to May. Two groups are identified, based on migration timing, ocean-age, and adult size. A-run steelhead, thought to be predominately age-1-ocean, enter freshwater during June through August. B-run steelhead, thought to be age-2-ocean, enter freshwater during August through October. B-run steelhead typically are three to four inches longer at the same age. Both groups usually smolt as 2- or 3-year-olds (Whitt 1954; Hassemer 1992). All steelhead are iteroparous, capable of spawning more than once before death.

Hydrosystem projects create substantial habitat blockages in this ESU; the major ones are the Hells Canyon Dam complex (mainstem Snake River) and Dworshak Dam (North Fork Clearwater River). Minor blockages are common throughout the region. Steelhead spawning areas have been degraded by overgrazing, as well as by historical gold dredging and sedimentation due to poor land management. Habitat in the Snake River Basin is warmer and drier and often more eroded than elsewhere in the Columbia Basin or in coastal areas.

Hatchery fish are widespread and stray to spawn naturally throughout the region. In the 1990s, an average of 86 percent of adult steelhead passing Lower Granite Dam were of hatchery origin. Hatchery contribution to naturally spawning populations varies, however, across the region. Hatchery fish dominate some stocks, but do not contribute to others.

For the SR Basin steelhead ESU as a whole, NMFS estimates that the median population growth rate (lambda) over the base period ranges from 0.91 to 0.70, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (Tables B-2a and B-2b in McClure et al. 2000).

B. Birds

1. Northern Bald Eagle *(Haliaeetus leucocephalus)*

The northern bald eagle was first listed as endangered in the lower 48 states in 1967, and was down-listed in 1978 to threatened status in Washington, Oregon, Minnesota, Wisconsin, and Michigan (USDI 1978). Since listing, bald eagle populations have increased in the Pacific Northwest as a result of recovery efforts including habitat protection and the banning of DDT and other persistent organochlorines. Habitat loss (from timber harvest, recreational and urban development, and mineral exploration and extraction) is the greatest long-term threat to bald eagle populations, even though shooting is the greatest single cause of mortality. A proposal to de-list the bald eagle was published in 1999 (USDI 1999a). Recovery plan goals in the Pacific Recovery Area, which includes Oregon and Washington, have been met. There has been no further action on the proposed rule.

Range: The bald eagle is found throughout North America, and has been documented on all of the National Forests covered by this Biological Assessment (Table 1). The largest breeding populations in the contiguous United States occur in the Pacific Northwest states, the Great Lakes states, Chesapeake Bay and Florida. Oregon and Washington are important for wintering bald eagles and support approximately 25 percent of the wintering bald eagles in the conterminous United States.

Habitat Requirements: Bald eagles are most common along coasts, major rivers, lakes and reservoirs (USFWS 1986), and require accessible prey and trees for suitable nesting and roosting habitat (Stalmaster 1987). Food availability, such as aggregations of waterfowl or salmon runs, is a primary factor attracting bald eagles to wintering areas and influences the distribution of nests and territories (Stalmaster 1987; Keister et al. 1987).

Bald eagle nests in the Pacific Recovery Area are usually located in uneven-aged stands of coniferous trees with old-growth forest components that are located within one mile of large bodies of water (USFWS 1986). Factors such as relative tree height, diameter, species, form, position on the surrounding topography, distance from the water, and distance from disturbance appear to influence nest site selection. Nests are most commonly constructed in Douglas-fir or Sitka spruce trees, with average heights of 116 feet and size of 50 inches dbh (Anthony et al. 1982 in Stalmaster 1987). Bald eagles usually nest in the same territories each year and often use the same nest repeatedly. Availability of suitable trees for nesting and perching is critical for maintaining bald eagle populations.

The critical period in Washington and Oregon when human activities could disturb occupied nest sites extends from January 1 until August 31 (U.S. Fish and Wildlife Service 1977; Isaacs et al. 1983). Nest initiation, including courtship and nesting building, occurs in January through March. Incubation occurs from March until late May, and young are in nests from early April through mid-August. Young usually remain in the nest area throughout August. Disturbance of nests during these times can result in reproductive failure due to nest abandonment by adults, egg and hatchling mortality due to exposure and predation, premature fledgling or nest evacuation, depressed feeding rates of adults and offspring, reduced or slower growth of nestlings, and avoidance of otherwise suitable habitat (U.S. Fish and Wildlife Service 1986).

Wintering bald eagles may roost communally in a single tree or large uneven-aged forest stands that have some old-growth forest characteristics (Anthony et al. 1982 in Stalmaster 1987). Some bald eagles may remain at their daytime perches through the night but bald eagles often gather at large communal roosts during the evening.

Communal night roosting sites are traditionally used year after year and are characterized by more favorable micro-climatic conditions. Roost trees are usually the most dominant trees of the site and provide unobstructed views of the surrounding landscape (Anthony et al. 1982 in Stalmaster 1987). They are often in ravines or draws that offer shelter from inclement weather (Keister 1987). A communal night roost can consist of two birds together in one tree, or more than 500 in large stand of trees. Roosts can be located near a river, lake, or seashore and are normally within a few miles of day-use areas but can be located as far away from water s 17 miles or more. Prey sources may be available in the general vicinity, but close proximity to food is not as critical as the need for shelter that a roost affords (Stalmaster 987).

Bald eagles utilize a wide variety of prey items, although they primarily feed on fish, birds and mammals. Diet can vary seasonally, depending on prey availability. Given a choice of food, however, they typically select fish. Many species offish are eaten, but they tend to be species that are easily captured or available as carrion. In the Pacific Northwest, salmon form an important food supply, particularly in the winter and fall.

2. **Marbled Murrelet *(Brachyramphus marmoratus)***

The marbled murrelet is a small seabird that nests along the Pacific Coast from Alaska to central California. Murrelets forage at sea, but nest on large limbs in old-growth coniferous forest. The Washington, Oregon, and California marbled murrelet populations were listed as threatened by in 1992 (USDI 1992a). Critical habitat was designated for the species in May 1996 (USDI 1996a). Six conservation zones for marbled murrelets were identified in the Marbled Murrelet Recovery Plan (USFWS 1997). The Puget Sound (Zone 1) and Western Washington Coast Range (Zone 2) encompass areas of the Mt. Baker-Snoqualmie, Olympic, and Gifford Pinchot National Forests, which are included in this Biological Assessment. None of the Forests within the range of the murrelet in western Oregon are included in this Biological Assessment (Table 1).

As part of the recovery planning process, a demographic model was developed to help better understand marbled murrelet population dynamics (Beissinger and Nur in Appendix B; USFWS 1997). The demographic model predicted that murrelet populations are likely to be declining at an estimated rate of 4 to 7 percent per pear. Predicting or estimating population trends for marbled murrelets is difficult because their population dynamics and demography have not been well described. Ralph et al. (1995) summarized some of the reasons for the variability in population estimates among researchers, including differences in methodology, assumptions, spatial coverage, and survey and model errors. Nevertheless, both Ralph et al. (1995) and the Marbled Murrelet Recovery Team (USFWS 1997) have concluded that the listed population appears to be in a long-term downward trend.

Habitat Requirements: Marbled murrelets are seabirds that are dependent upon old-growth forests, or forests with an older tree component, for nesting habitat (Hamer and Nelson 1995b; Ralph et al. 1995). Booth (1991) concluded that 82 to 87 percent of the old-growth forests that existed in western Washington and Oregon prior to the 1840's is now gone. Sites occupied by murrelets tend to have a higher proportion of mature forest classes than do unoccupied sites (Raphael et al. 1995). These forests are characterized by multi-layered canopies and high composition of low elevation conifer trees, and typically occur on the lower two-thirds of forested slopes (Hamer and Nelson 1995b). Nests are located on large branches and platforms such as mistletoe brooms. Marbled murrelets forage predominantly within 1.2 mile (2 km) of shore (Strachan et al. 1995), although the species can be found further offshore (Piatt and Naslund 1995; Ralph and Miller 1995).

Approximately 1,631,300 acres (660,180 hectares) were designated as critical habitat in Washington with approximately 74 percent of the area on federal lands, primarily in Late Successional Reserves as established in the Forest Plan (USFWS 1997, Appendix A). The primary constituent elements (the physical and biological habitat features) for designating marbled murrelet critical habitat were identified as individual trees with potential nest platforms and forest lands of at least one half site potential tree height regardless of contiguity within 0.8 km (0.5 mile) of individual trees with potential nesting platforms. Within the boundaries of designated critical habitat, only those areas that contain one or more primary constituent elements are, by definition, critical habitat.

The early nesting season for murrelets includes egg-laying, incubation, and hatching, and occurs from April 1 to August 5 in Washington State. The late nesting season, when murrelets are feeding young, occurs from August 6 to September 15. During the late season period, the majority of feedings take place at dawn and dusk, during the 2 hours after sunrise and the 2 hours before sunset (Nelson and Hamer 1995). Disturbance of nest sites during these periods can result in avoidance of an area for nesting, aborted feeding, nest abandonment, pre-mature fledging and flushing of adults from the nest resulting in increased vulnerability of eggs or young to predation. From 1974 through 1993, approximately 64% of the nests failed where nest success/failure was documented, and 57% of those that failed were due to predation (primarily by ravens, crows, and jays) (USFWS 1997).

3. **Northern Spotted Owl** ***(Strix occidentalis caurina)***

The northern spotted owl was listed as a threatened species throughout its range in Washington, Oregon and northern California in 1990 (USDI 1990a). The listing was in response to widespread habitat loss across its entire range and to the inadequacy of existing regulatory mechanisms to provide for its conservation.

Range: The northern spotted owl is one of three subspecies (northern, California, and Mexican) and occurs from British Columbia to northern California. The northern spotted owl is associated with late successional and old-growth forest habitats. The owl also occurs in some younger forest types where structural attributes of old-growth forests are present (Washington DNR 1997). The present range of the northern spotted owl is similar to the limits of its historic range (USDI 1992b). Forests and BLM Districts within the scope of this Biological Assessment where the spotted owl occurs are identified in Table 1.

Habitat requirements: The owl's biology and ecology are well known and are described in numerous publications, such as Forsman et al. (1984), the Interagency Scientific Committee Report (Thomas et al. 1990), the 1990 Status review (USDI 1990b) the final rules for listing and critical habitat (USDI 1990a and 1992a), the final draft spotted owl recovery plan (USDI 1992c), the report of the Scientific Analysis Team (Thomas et al. 1993), the Forest Ecosystem Management Assessment Team report (FEMAT 1993) and recent demographic reports (Forsman et al. 1996 and Franklin et al. 1999). The Northwest Forest Plan is considered to be the Federal contribution to owl recovery (USDA/USDI 1994).

Spotted owls nest, roost and feed in a wide variety of habitat types and forest stand conditions throughout their range, with most observations occurring in areas having a component of old-growth and mature forests. Owls in managed forests usually occupy areas with structural diversity and a high degree of canopy closure, containing large diameter or residual old trees, in stands more dm 60 years old (USDI 1992b). Cavities or broken-top trees are more frequently selected in older forests and platforms (mistletoe brooms, abandoned raptor and gray squirrel nests, and debris accumulations) tend to be selected more frequently in younger forests (Forsman et al. 1984). Spotted owls begin their annual breeding cycle in late winter (February or March) and dispersal of juvenile owls begins in early fall (USDI 1992a).

Although habitat that allows spotted owls to disperse may be unsuitable for nesting, roosting and foraging, it provides an important linkage among blocks of nesting habitat both locally and over the range of the northern spotted owl. This linkage is essential to the conservation of the spotted owl. Dispersal habitat, at minimum, consists of forest stands with adequate tree size and canopy closure to protect spotted owls from avian predators and to allow the owls to forage at least occasionally (USDI 1995).

On January 15, 1992, approximately 6.88 million acres (2.8 million hectares) was designated as critical habitat for the northern spotted owl in Washington, Oregon, and California. Critical habitat was only designated on Forest Service and Bureau of Land Management lands and not on other land ownerships. Critical habitat areas are aligned very closely with the Late Successional Reserves defined in the Northwest Forest Plan (USDA/USDI 1994)

Critical habitat is based on the identification of primary constituent elements of the environment that are important to conservation, (i.e. recovery of the listed species. For the spotted owl these elements reflected the principles for owl conservation established by Thomas et al. (1990) and included large blocks of suitable owl habitat and/or connectivity between blocks that would support dispersal. The final rule recommended the physiographic province as the primary basis for assessing actions under section 7 of ESA. A complete description of owl critical habitat is found in the final rule designating critical habitat (USDI 1992a).

The early nesting season for the northern spotted owl in Washington has been identified as the period from March 1 through July 15. For the Fremont-Winema NF in Oregon the early nesting season occurs from March 1 through August 15. On the Deschutes NF, where data is lacking for fledging dates, the period extends from March 1 through September 30. The early nesting season is when egg-laying, incubation, hatching, feeding of the nestlings, and fledging occurs, and active nest sites could be affected by disturbance.

C. Mammals

1. Canada Lynx (*Lynx canadensis*)

The Canada lynx was listed as threatened in the contiguous United States on March 24, 2000 (USDI 2000). In the final rule, the Fish and Wildlife Service concluded that the single factor threatening the population was the inadequacy of existing regulatory mechanisms, specifically the lack of guidance for conservation of lynx in National Forest Land and Resource Management Plans and the BLM Land Use Plans.

Range: Historically and currently, lynx were and are present in Alaska and Canada from the Yukon and Northwest Territories east to Nova Scotia and New Brunswick and south into the continental U.S. Records document lynx occurrence in 24 states, including Washington and Oregon (McKelvey 2000). In Region 6 of the Forest Service, lynx habitat has been identified on the Okanogan/Wenatchee, Colville, Mt. Baker-Snoqualmie, Malheur, Wallowa-Whitman, Umatilla and Deschutes National Forests. Each National Forest maintains a map of lynx habitat.

Habitat Requirements: Habitat requirements for lynx have been addressed in detail in several publications (Ruggerio et al. 1994, Ruediger et al. 2000, USDA 1999 and USDI 2000). Canada lynx are associated with conifer forests that are southern extensions of northern boreal forest, a pattern that conforms to our biological understanding of lynx habitat (McKelvey 2000; Ruediger et al. 2000). Lynx habitat quality is believed to be lower in the southern periphery of its range, because landscapes are more heterogeneous in terms of topography, climate and vegetation (Buskirk et al. 2000). In Oregon and Washington, lynx habitat is correlated very closely with subalpine fir vegetation types.

Canada lynx are specialized predators and their distribution coincides with the snowshoe hare. Studies in the southern portion of lynx range (Koehler 1990, Apps 2000, Squires and Laurion 2000) documented starvation as a primary cause of adult lynx mortality. The same studies reported low kitten survival. The LCAS provided guidance on maintenance of young, dense conifer vegetation to support higher densities of snowshoe hare. The LCAS also discussed the importance of mature, multiple-storied conifer vegetation that has dense horizontal cover at snow/ground level to snowshoe hare. Murray et al. (1994), Buskirk et al. (2000), Parker et al. (1983), and Dolbeer and Clark (1975) also described this condition. These two vegetation conditions, young, dense conifer and older, multi-storied stands, are very important to lynx because they support conditions suitable to higher densities of snowshoe hare.

Snowshoe hare habitat is characterized by forests that provide dense, low horizontal cover (Hodges 2000). Snowshoe hares appear to reach their highest densities in dense, early successional forests with woody seedlings and shrubs, which provide food and cover, and escape from predators and extreme weather (Wolfe et al. 1982; Monthey 1986; Koehler and Aubry 1994). Lynx usually select habitats with an abundance of snowshoe hares for foraging. They use the abundant cover to stalk and lie in wait for hares (Ruggiero et al. 1994).

Lynx require late-successional forests that contain cover for kittens (especially deadfalls) and for den sites (Koehler and Brittell 1990). Breeding occurs in late March to early April, and young are born in late May or early June (Koehler and Aubry 1994). Lynx populations in Alaska and Canada exhibit a cyclic oscillation in population with lynx lagging several years behind snowshoe hare population trends. This relationship does not appear to exist in the contiguous United States due to lower snowshoe hare populations resulting from patchier habitat and the presence of additional competitors and predators not present in the northern regions (Dolbeer and Clark 1975; Wolff 1980,1982).

2. **Gray Wolf *(Canis lupus)***
The gray wolf was listed as endangered in 1978. In 1930, it was believed that breeding populations of wolves in Washington were extinct because of fur trading pressure in the 1800's followed by the establishment of bounties on all predators in 1871 in the Washington Territory (Young and Goldman 1944). Recent observations indicate that wolves exist in Washington, likely in small numbers, and mostly as individuals. Several family units have been documented, indicating that some level of recolonization has occurred recently (Almack and Fitkin 1998). Olterman and Verts (1972) considered wolves to have been extirpated from Oregon since the last animal was bountied in 1946. However, single animals from the experimental population in Idaho have been sighted in northeastern Oregon within the last five years (including a radio-collared animal). In March 2003, the species federal status was down-listed from endangered to threatened in the Western Distinct Population Segment which includes Oregon and Washington (USDI 2003).

Range: The probable range of gray wolves in Washington is in the Cascade Mountains and northeastern Washington (Almack and Fitkin 1998). In northeastern Washington, the majority of the reported wolf activity is in the eastern half of the Colville National Forest and Colville Indian Reservation and also adjacent private and public lands. (Hansen 1986). In Oregon, the wolf was considered to occur mainly in the Willamette Valley and west to the Coast at the time of European settlement and to continue to occur west of the Cascade Range during the first third of the 19th century (Bailey 1936, Verts and Carraway 1998). The wolf was associated with forested areas in Oregon probably because these areas provided some refuge from persecution by humans and supported prey species (Verts and Carraway 1998). Elsewhere in historic times, the wolf was not restricted to forested areas; its presence was likely determined by prey availability (Carbyn 1983).

Habitat Requirements: The habitat of the gray wolf is identified as open tundra and forests (Whittaker 1980). However, gray wolves can use a variety of habitats as long as cover and a food supply are available (Stevens and Lofts 1988). They tend to focus on areas that are free from human disturbance and harassment, have low road densities and which support large numbers of prey species (deer, elk, goat, moose, and beaver). While they may consume some small mammals, most of their diet consists of ungulates (Peterson 1986).

Wolves follow the movements of ungulate herds (deer, elk, moose) across openings and through forested areas. The major tree species in this area include white pine, lodgepole pine, Douglas-fir, larch, subalpine fir, grand fir, and a number of less common species including ponderosa pine, whitebark pine, spruce, hemlock, and red cedar (Hansen 1986). Wolves have territories ranging from 70 to 800 square miles.

Wolves generally live in packs made up of 2 to 12 or more family members and individuals, lead by a dominant male and female. In other locations, denning by wolves generally occurs between April and June. Den sites often have forested cover nearby and are distant from human activity. The pups remain at the den site for the first 6 to 8 weeks, then they move to a rendezvous site until they are large enough to accompany the adults on a hunt (Peterson 1986). Once the pups are large enough to go hunting, the pack travels throughout its territory.

3. **Grizzly bear *(Ursus arctos horribilis)***

The grizzly bear was listed as a threatened species in the conterminous United States in 1975. Livestock depredation control, habitat deterioration, commercial trapping, unregulated hunting, and protection of human life were leading cause of the decline of grizzly bears (USFWS 1993). Two of the six ecosystems identified in the grizzly bear recovery plan (USFWS 1993) are in Washington, the Northern Cascades Recovery Zone and the Selkirks Recovery Zone. Almack et al. (1993) estimated the 1991 grizzly bear population in the North Cascades recovery area at less than 50, and perhaps as low as 5 to 20.

Range: Historically, in North America, the grizzly's range extended from the mid-plains westward to the California coast and south into Texas and Mexico (USFWS 1993). In Washington, the grizzly's range is limited to the North Cascades and the Selkirk mountains (Mt Baker-Snoqualmie, Okanogan/Wenatchee and Colville NFs). In Oregon, the grizzly bear is considered extirpated (Verts and Carraway 1998).

Habitat Requirements: Grizzly bear habitat use is determined by isolation from human disturbance, food distribution, food availability, and den security. In general, grizzly bears move seasonally, using low-elevation riparian areas and meadows in the spring, higher elevations during the summer and fall months, and high isolated areas for winter dens.

Little is known about the grizzly bears residing in the North Cascades. It is suspected that their habits are similar to bears from other areas. Information presented here is from studies in the Selkirk Mountains and other areas. Denning occurs most commonly on north-facing slopes above 6,000 feet elevation in areas where snow drifts and remains through warm spells (USFS 1994). Grizzly bears leave their den sites after the cubs are born in February. They move quickly down to low elevation areas and feed on winter-killed ungulates and new herbaceous growth. Grizzly bears generally feed on emerging grasses, forbs, and budding shrubs in the spring. As green-up moves up-slope, the bears follow, foraging above 3,000 feet in the summer. Grizzly bears breed on their summer range between May and July. In late summer and fall, bears forage on berries such as huckleberry, serviceberry, rose, and strawberry. In September or October bears move to high elevations and den sites. Grizzly bears may concentrate their use in mixed shrub fields, snow chutes, old burns, meadows, and cutting units.

Human disturbance, usually increased with road access into grizzly habitat, is known to affect bear use of seasonal habitat components. In general, roads increase the probability of bear-human encounters and human induced mortality (USFS 1994).

4. Woodland Caribou *(Rangifer tarandus caribou)*

The woodland caribou was federally listed as endangered in 1983. As recently as the 1950s, the South Selkirk Mountains population consisted of an estimated 100 animals (Evans 1960). However, by the early 1980s, the population had declined to 25-30 animals whose distribution centered around Stagleap Provincial Park, British Columbia (Scott and Servheen 1985). Stagleap is a small park located a few miles north of the U.S. - Canadian border.

The U.S. population was augmented in 1987, 1988, and 1990 by transplanting a total of 60 animals from central British Columbia into northern Idaho. In 1996-1998, a total of 43 woodland caribou were transplanted into northeast Washington and Stagleap Provincial Park. The current population estimate for the ecosystem is 37 animals (Audet pers. com. 2002).

Habitat fragmentation and loss, predation, poaching, and disease have all contributed to the decline of woodland caribou in North America. The small, South Selkirk

Mountains population is extremely vulnerable to predation, accidental deaths and poaching (USFWS 1994). Since the late 1980s, habitat for caribou in the ecosystem has been managed according to guidelines developed by the U.S. Forest Service, B.C. Ministry of Environment, and Idaho Department of Lands, which were developed in an attempt "to minimize the effects of logging on caribou and…to develop silvicultural standards that may enhance habitat over the long term." (USFWS 1994). The potential for habitat loss due to large wildfires or insect/disease attack is an ongoing management concern.

Range: Prior to 1900, woodland caribou were distributed throughout much of Canada and the northeastern, north-central, and northwestern coterminous United States. Since the 1960's, the woodland caribou population has restricted its range to the Selkirk Mountains of northeastern Washington, northern Idaho and southeastern British Columbia. In Washington state, caribou are found east of the Pend Oreille River in Pend Oreille County.

The recovery area for caribou in the South Selkirk Mountains is comprised of approximately 5,700 km2. About 47 percent of the area lies in British Columbia and 53 percent lies in the United States. The United States portion includes the Salmo-Priest Wilderness and other portions of the Colville and Idaho Panhandle National Forests, Idaho Department of Lands holdings, and scattered private parcels (USFWS 1994).

Habitat Requirements: Woodland caribou are generally found on moderate slopes above approximately 1,200 m (4,000 feet) elevation in the Selkirk Mountains in Englemann spruce/subalpine fir and western red cedar/western hemlock forest types (USFWS 1994). Caribou use streams, bogs, basins, and other areas that are no more than 35 percent slope and are composed of mature or old-growth timber (Freddy 1974; Simpson and Woods 1987).

Woodland caribou that inhabit the Selkirk Mountains are of the mountain ecotype. Generally these animals exhibit distinct seasonal movements. In early winter caribou shift to lower elevation habitats (1200 and 1900 meters/4,000-6,200 feet) that are best characterized by mature to old-growth western hemlock/western red cedar forest types. Selkirk Mountains caribou have returned to the same areas of early winter habitat year after year and it is considered to be the most critical habitat to the Selkirk population. Late winter habitat is characterized by deep snow and is generally above 1,828 m (6,000 ft) elevation in open canopy forests of subalpine fir / Englemann spruce. At this time of year the snow pack has consolidated enough for caribou to walk on top of it with their huge, spreading feet. The deep snows "lift" the animals up into the trees and allow them better access to arboreal lichens; their preferred winter food.

In spring, caribou move to areas that are "greening up" that provide high quality forage. Pregnant females move back onto snow-covered areas, often at higher elevations, to calve in early June. Servheen and Lyon (1989) found certain habitat characteristics to be constant for most seasonal habitats in the Selkirk Mountains: 1) a high abundance of lichens; 2) 30 percent of stands had tree crown canopy greater than 50 percent; and 3) stem diameter were greater than 20 cm (8 in.), except at higher elevations.

Arboreal lichen represents almost the sole winter diet of woodland caribou. Selkirk Mountains caribou generally depend on arboreal lichens for up to 6 months of the year (USFWS 1994). During the warm months their diet consists of new herbaceous vegetation, mushrooms, shrub leaves, grasses, sedges, and soft shrubs. Summer and early winter are critical times in which quality and availability of forage may be limiting to populations (Simpson et al. 1988).

Predation from mountain lions (*Puma concolor*) may have contributed to the decline of the last population of endangered mountain caribou (*Rangifer tarandus caribou*) in the United States (Katnik 2002).

D. Plants

1. Howell's Spectacular Thelypody *(Thelypodium howellii spectabilis)*

Thelypodium howellii spectabilis is federally listed as threatened in 1999 (USDI 1999c), and a recovery plan was completed for the species in 2002 (USFWS 2002). This member of the mustard family occurs on fewer than 12 small sites located within 100 acres of private lands near North Powder, Baker and Haines in eastern Oregon (Baker and Union Counties). The species historically occurred in Malheur County, Oregon, but is considered extirpated from that location. The species is suspected (based on habitat), but not documented, on the Wallowa-Whitman NF.

Habitat Requirements. The thelypody grows in mesic, alkaline meadow habitats in valley bottoms, usually in and around shrubs such as greasewood or rabbitbrush. Soils are pluvial-deposited alkaline clays mixed with recent alluvial silts, and are moderately well drained. In Baker County, over half of the known occurrences occur on Haines or Umpine silt loam with gradients between 0 and 2 percent. Other low gradient soils that support this species include the Baldock, Stanflow-Umpine, and Wingville silt loam types. Flowing typically occurs from June through July. Plants are threatened by habitat modification such as grazing during spring and early summer, trampling, urban development, and competition from non-native plants.

2. MacFarlane's Four-O'clock (*Mirabilis macfarlanei)*

MacFarlane's Four-O'clock was first listed as endangered in 1979, and was reclassified to threatened in 1996 due to improvement in the status of the species and discovery of additional populations (USDI 1996b). The species now occurs in three geographically isolated units in Oregon and Idaho. The population in the Snake River Unit occurs on Wallowa-Whitman National Forest lands, with the majority of the plants in the Hells Canyon National Recreation Area. A recovery plan was completed for the species in 1985.

Habitat Requirements. *Mirabilis macfarlanei* generally occurs as scattered plants on open, steep talus slopes within canyon land corridors. Because *Mirabilis* taxa are mainly restricted to the southwest, it is unusual for this species to exist as far north as west-central Oregon and northeastern Oregon, and it is thought that the genus expanded northward during a period of warmer climate. Discovery of additional localities on public lands, better grazing management, and the static condition of existing populations in both the Salmon River and the Snake River evolutionary units have reduced the degree of threat to this species. However, continued threats include lack of recruitment in some areas, insect predation, and alien plant invaders.

3. **Marsh Sandwort (*Arenaria paludicola)***
   Arenaria paludicola was listed as endangered in 1993 (USDI 1993). This species was historically known from swamps and freshwater marshes in four counties in California, as well as Washington State, but the sole extant population occurs at Black Lake Canyon in San Luis Obispo County, California. The only known collection of *Arenaria paludicola* in Washington was in 1896 near Tacoma. This species has not been documented on any of the Forests included in this BA, but is suspected to occur on the Olympic NF.

   Habitat Requirements: *Arenaria paludicola* is an obligate wetland species that requires highly saturated soils to persist. The primary threats are urban development, alteration in hydrology, competition with alien plant species, and stochastic extinction due to the small number of individuals and populations that remain.
4. **Showy Stickseed *(Hackelia venusta)***
   Hackelia venusta was listed as endangered in 2002 (USDI 2002a). This species is a narrow endemic restricted to one small population of approximately 500 plants on less than 2.5 acres (1ha) of unstable, granitic talus on the lower slopes of Tumwater Canyon, Chelan County, Washington. This site is located on the Okanogan-Wenatchee NF.

   Habitat Requirements: *Hackelia venusta* is shade intolerant and grows in openings within Ponderosa pine and Douglas-fir forest types. It is found on open, steep slopes (minimum of 80% inclination) of loose, well-drained, granitic weathered and broken rock fragmented soils at an elevation of about 1,600 feet (486 meters) (USDI 2002a). Threats to the species include habitat modification associated with fire suppression, competition and shade from native shrubs and trees and nonnative noxious weeds, maintenance of the highway located near the known population, low reproductive capacity, and incidental loss from human trampling.
5. **Spalding's Catchfly *(Silene spaldingii)***
   Spalding's Catchfly was listed as threatened in 2001 (USDI 2001b), and at the time of listing, it was known from a total of 52 populations in the United States and British Columbia, Canada. Seven of these populations occurred in Oregon (Wallowa County) and 28 in Washington (Asotin, Lincoln, Spokane, and Whitman Counties). For the area covered by this BA, it has been documented on the Umatilla and Wallow-Whitman NFs. Much of the remaining habitat occupied by *Silene spaldingii* is fragmented. Additional threats are habitat destruction and further fragmentation by agricultural and urban development, trampling by native herbivores and livestock, herbicide treatment, and competition from nonnative plants species.

   Habitat Requirements. Spalding's Catchfly is primarily restricted to mesic prairie or steppe vegetation of the Palouse region, which is considered a subset of the Pacific

Northwest bunchgrass habitat type. More than 98% of the original Palouse prairie habitat type has been lost or modified. The species is also found in canyon grassland habitat dominated by the same bunchgrass species as Palouse prairie, but the two habitat types differ in their overall plant species composition as well as topography. Canyon grasslands occur in steep, highly dissected canyon systems whereas Palouse grasslands generally occur on gently rolling plateaus.

6. **Ute Ladies'- Tresses (*Spiranthes diluvialis)***
   *Spiranthes diluviali*s *was* federally listed as threatened in 1992 (USDI 1992c) when it was only known from Colorado, Utah, and Nevada. However, since that time, it has been found in Wyoming, Montana, Nebraska, Idaho and Washington. The species is located in Okanogan and Chelan Counties in Washington State, but has not been documented on federal land, although it is suspected to occur on the Okanogan-Wenatchee NF, and also on the Wallowa-Whitman NF in Oregon. The main threat factors cited for listing were loss and modification of habitat and the hydrological conditions of existing and potential habitat. The orchid's pattern of distribution in small, scattered groups, restricted habitat, and low reproductive rate under natural conditions make it vulnerable to both natural and human-caused disturbances. A draft recovery plan was issued in 1995 (USFWS 1995).

   Habitat Requirements. Ute ladies'-tresses is a perennial, terrestrial orchid that is endemic to moist soils in mesic or wet meadows near springs, lakes, or perennial streams (USFWS 1995). The species is found in a variety of soil types ranging from fine silt/sand to gravels and cobbles, and has also been found in highly organic or peaty soils. The species has not been found in heavy or tight clay soils or in extremely saline or alkaline soils (pH>8.0) (USFWS 1995). It is generally intolerant of shade, preferring open grass and forb-dominated sites.
7. **Water Howellia (*Howellia aquatilis)***
   Howellia aquatilis, a wetland plant, was listed as a threatened species in July 1994 (USDI 1994). The historic range of this species included California, Idaho, Montana, Oregon and Washington, but the range has subsequently been reduced to Idaho, Montana and Washington (USDI 1994). It has been reported from Clackamas, Marion, and Multnomah Counties in Oregon, and from Mason, Thurston, Clark and Spokane Counties in Washington. It is believed to have been extirpated from California and Oregon, and from Mason and Thurston Counties in Washington. Extant populations occur in Washington in Spokane and Clark Counties. The species has not been documented on any Forest included in this BA, but is suspected based on presence of potential habitat on the Gifford Pinchot and Okanogan-Wenatchee NFs.

   Habitat Requirements. *Howellia aquatilis* is an aquatic annual plant that is restricted to small vernal, freshwater, ephemeral wetlands which have an annual cycle of filling up with water over the fall, winter and early spring, followed by drying during the summer months. The species grows in firm consolidated clay and organic sediments that occur in wetlands associated with ephemeral glacial pothole ponds and former river oxbows. The plant's microhabitats include shallow water and the edges of deep ponds that are partially surrounded by deciduous trees.

Howellia aquatilis has narrow ecological requirements and subtle changes in its habitat could affect a population. Threats to the populations include loss of wetland habitat and habitat changes due to timber harvest and road building, livestock grazing, residential and agricultural development, alteration of the surface or subsurface hydrology, and competition from introduced plant species such as reed canary grass *(Phalaris arundinacea)* and purple loosestrife *(Lythrum salicaria)* (USDI 1994).

8. **Wenatchee Mountains Checker-Mallow (*Sidalcea oregana var. calva)***

The Wenatchee Mountains Checker-Mallow was federally listed as endangered in 1999 (USDI 1999b). Critical habitat was designated in 2001 (USDI 2001a). Although the species *Sidalcea oregana* (Oregon checker-mallow) occurs throughout the western United States, *S. oregana var. calva* is known only to occur at six sites (populations) in the mid-elevation wetlands and moist meadows of the Wenatchee Mountains in central Washington state (USDI 2001a). The only unit included in this BA where the species has been documented is the Okanogan-Wenatchee NF.

Habitat Requirements: *Sidalcea oregana var. calva* is most abundant in moist meadows that have surface water or saturated upper soil profiles during spring and early summer. It may also occur in open conifer stands dominated by ponderosa pine (*Pinus ponderosa)* and Douglas-fir (*Pseudotsuga menziesii*) and on the margins of shrub and hardwood thickets. Populations are found at elevations ranging from 1,900 to 4,000 feet. Soils are typically clay-loam and silt-loams with low moisture permeability. *Sidalcea oregana var. calva* is a perennial plant with a stout taproot that branches at the root crown and gives rise to several stems that are 20 to 150 centimeters in length. Pink flowers begin to appear in middle June and peaks in the middle to end of July. Fruits are ripe by August (USDI 1999b).

The primary threats to this species include alterations of hydrology, rural residential development and associated activities, competition from native and alien plants, recreation, fire suppression, and activities associated with fire suppression. To a lesser extent threats include livestock grazing, road construction, and timber harvesting and associated impacts including changes in surface-runoff in the small watersheds in which the plant occurs (USDI 1999b).

The area designated as critical habitat for the Wenatchee Mountains Checker-Mallow includes all of the lands that have the primary constituent elements below 1,000 m (3,300 ft) within the Camas Creek watershed and in the small tributary within Pendleton Canyon before its confluence with Peshastin Creek, and includes: (1) The entire area encompassed by the Camas Meadow Natural Area Preserve, which is administered by the WDNR; (2) two populations located on Forest Service land; (3) the small drainage north of the Camas Land, administered by the WDNR; (4) the population on private property located in Pendleton Canyon; and (5) the wetland complex of these watersheds necessary for providing the essential habitat components on which recovery and conservation of the species depends (USDI 2001a). Portions of the designated critical habitat are presumably unoccupied by *Sidalcea oregana* var. *calva* at present, although the entire area has not been recently surveyed. Soil maps indicate that the entire area provides suitable habitat for the species, and there may be additional, but currently unknown, populations present (USDI 2001a).

IV. Action Area and Environmental Baseline

A. Description of Geographic Scope and Action Area

For the purpose of this BA, the geographic scope where programmatic activities can be implemented covers that portion of Oregon east of the Cascade Mountains' crest and the whole of Washington, where ever FS administrative units are found. Those portions of the Mt. Hood National Forest, which occur east of the Cascade Mountains' crest, and the Crooked River National Grasslands are excluded. Further, the programmatic area includes non-federal lands where activities help achieve fish passage goals on National Forest System lands. To be included, such non-federal land projects must follow all aspects of the proposed action as outlined in Chapter II. The FS administrative units not included are currently covered by FWS and/or NOAA Fisheries Biological Opinions for culvert replacement projects or do not have ESA-listed fish species needing coverage.

Contained within the geographic area, site-specific action areas are located at stream road crossings where culverts are to be removed or replaced. The action area includes all areas to be affected directly or indirectly by the programmatic activities and not merely the immediate project area. Because programmatic activities may temporarily prevent fish passage during construction and permanently restore access for all fish species and life stages after construction, the upstream limit of the action area will be determined by the upper limit of accessible habitat. The downstream limit shall be no greater than 2 miles because downstream turbidity, resulting from construction, usually becomes undetectable at this point. For the evaluation of potential harassment of spotted owls and marbled murrelets, the action area shall be within 75 yards (for construction machinery), 120 yards (for helicopter) or 270 yards (for blasting) from the activity generating noise above ambient levels.

B. Environmental Baseline for Aquatic Species

Reeves et al. (1995) states that recovery programs must identify ecosystem processes that create and sustain fish habitat through time as well as the causes that have altered those processes. For the purpose of describing baseline conditions related to this programmatic, the FWS (USDI 1998b) and NOAA Fisheries (NMFS 1996) Matrix and Pathways and Indicators will be used as surrogates to ecosystem processes. Therefore, the environmental baseline will be presented in the following manner. First, brief descriptions will be provided for each matrix indicator as a means to define baseline. Second, common factors of decline, which have affected the properly functioning status of indicators, shall be provided. Thirdly, the indicators to be moved toward a "Degrade" condition for actions implemented under this BA will be assessed as being either Properly Functioning (PF), Functioning but At-Risk (FAR), or Functioning at Unacceptable Risk (FUR) for each of the 50 fourth field sub-basins included in the geographic area. Definitions for PF, FAR, and FUR are defined by the FWS (USDI 1998b) and NOAA Fisheries (NMFS 1996). Chapter V provides additional discussion regarding the ways in which matrix indicators were classified as either “Degrade,” “Maintain,” or Restore.”

1. **Description of Matrix Indicators**
   The FWS and NOAA Fisheries Matrix of Pathways and Indicators share the following indicators: 1) temperature, 2) sediment/turbidity, 3) chemical concentration/nutrients 4) physical barriers 5) substrate, 6) large woody debris, 7) pool frequency/quality/depth, 8) off-channel habitat, 9) refugia 10) width/depth ratio, 11) streambank condition, 12) floodplain connectivity, 13) change in peak/base flow, 14) increase in drainage network, 15) road density and location, 16) disturbance/regime history, and 17) riparian reserves. In addition, the FWS has four additional indicators: subpopulation size, growth and survival, life history, genetic integrity. The descriptions, given below, provide the ways in which each indicator serves as an essential ecological function necessary for the overall viability of fish stocks.
   a. **Water Temperature –** Water temperatures affect the survival and production of fish throughout all life stages. For instance, a study of Chinook salmon survival from fertilization to hatching demonstrated that those eggs incubated at 15.0˚C had a 23% survival rate while those incubated at 9.9 and 11.4˚C had a 49 and 50% survival rate, respectively (Garling and Masterson 1985). In Chum salmon, embryo survival was demonstrated to be highest at 11˚C (Murry and McPhail 1988), hatching success of rainbow trout reaches its maximum at 10-12˚C (McCullough 1999), and preferred temperatures for bull trout ranges are 2-4˚C (McPhail and Murray 1979). Next, changing water temperatures affect juvenile fish. Juvenile (fry, fingerling, parr) Chinook demonstrate optimum growth between 10.0-15.6˚C (Armour 1990). Growth drastically declines or ceases at 19.1˚C (Armour 1990) and is accompanied by decreased feeding, increased stress, and warm water diseases. Juvenile bull trout are usually found in water temperatures below 12˚C (Goetz 1994). Finally, at a certain point, temperatures become lethal for all fish. McCullough (1999), citing numerous studies, stated that temperatures above 21˚C equal or exceed incipient lethal temperatures for Columbia River Chinook stocks and steelhead stocks migrating during the summer season. The best bull trout habitat in Oregon streams seldom exceeded 15˚C (Buckman et al. 1992; Ratliff 1992; Ziller 1992).
   b. **Sediment/Turbidity –** Increased levels of sedimentation often have adverse effects on fish habitats and riparian ecosystems. Fine sediment deposited in spawning gravels can reduce egg survival and developing alevins (Everest et al. 1987; Hicks et al. 1991) by reducing the availability of dissolved oxygen in the gravel. Primary production, benthic invertebrate abundance, and thus, food availability for fish may be reduced as sediment levels increase (Cordone and Kelley 1961; Loyd et al. 1987) due to reductions in photosynthesis within murky waters. Social (Berg and Northcoate 1985) and feeding behavior (Noggle 1978) can be disrupted by increased levels of suspended sediment. Pools, which are an essential habitat type, can be filled by sediment and degraded or lost (Kelsey et al. 1981; Megahan 1982).
   c. **Chemical Contamination/Nutrients –** Aquatic ecosystem perturbations related to chemical contamination include thermal pollution, toxicity due to organic compounds and heavy metals, organic wastes and resulting changes in dissolved

oxygen, acidification, and increased eutrophication. Sources of these chemical inputs commonly result from industry, urban development and agriculture.

d. **Physical Barriers –** Human constructed physical barriers within the stream channel, such as culverts and irrigation weirs, can impair sediment and debris transport, life history patterns, and population viability. First and second order streams, which generally include permanently flowing non-fish bearing streams and seasonally flowing or intermittent streams, often comprise over 70 percent of the cumulative channel length in mountain watersheds in the Pacific Northwest (Benda et al. 1992). These streams are the sources of water, nutrients, wood, and other vegetative material for streams inhabited by fish and other aquatic organisms (Swanson et al. 1982; Benda and Zhanag 1990; Vannote et al. 1980). Decoupling the stream network (through physical barriers) can result in the disruption and loss of functions and processes necessary for creating and maintaining fish habitat. Further, physical barriers prevent the movement of fish in their fulfillment of life history functions. Culverts, for instance, prevent juvenile fish from reaching rearing habitats (Furniss et al. 1991) and have blocked significant amounts of historical anadromous salmonid habitat (Roni et al. 2002). Even more, barriers restrict the expression of various life history forms within a species. Migratory movements of fluvial or adfluvial forms of bull trout, for example, can be restricted or prevented, and such a loss of life history forms restricts the full potential of fish production. Finally, strong populations rely on unimpeded access between watershed reserves, those areas of high quality habitat occupied by viable subpopulations, for dispersion and genetic interchange (Noss et al. 1997).

e. **Substrate (excerpts from Rieman and McIntyre 1993) –** This indicator is similar to "Sediment" in that it addresses fines and their effects on fish habitat. Unlike "Sediment," which addresses spawning and incubation, the substrate indicator assesses fines and their effects on rearing habitat within channel substrate. The NMFS (1996) notes that rearing capacity of salmon habitat decreases as cobble embeddeness levels increase, resulting from increased sedimentation. Furthermore, overwintering rearing habitat within substrate may be a limiting factor to fish production and survival, and the loss of this overwintering habitat may result in increased levels of mortality during rearing life stages. Likewise, when the percent of fine sediments in the substrate was relatively high, rearing bull trout were also less abundant (USDI 1998b).

f. **Large Woody Debris (lwd) –**Large woody debris in streams is an important roughness element influencing channel morphology, sediment distribution, and water routing (Swanson and Lienkaemper 1978, Bisson et al. 1987). Large woody debris influences channel gradient by creating step pools and dissipating energy (Heede 1985), lengthens streams by increasing sinuosity (Swanston 1991), and serves as an important agent in pool formation (Montgomery et al.1995). In low order streams, in particular, lwd collects sediment and larger substrates during high flow events (Keller et al. 1985) and can account for 50% of the sediment/substrate storage sites (Megahan 1982). Further, lwd is instrumental in nutrient retention by capturing and storing salmon carcasses (Cederholm and Peterson 1985) and allochthonous materials, a primary energy source for smaller rivers and streams (Gregory et al. 1991). The resulting effect of lwd on fish habitat is significant.

Crispin et al. (1993) noted increased salmon spawning activity in an area where gravels accumulated behind lwd. Bjornn and Reiser (1991) cited several studies that documented an increase in fish densities with higher levels of lwd, and Fausch and Northcote (1992) documented that coho salmon and cutthroat trout production was greater in lwd-dominated streams, where pools, sinuosity, and overhead cover were greatest. The role of lwd decreases as streams become larger, because greater currents will carry lwd out of the active channel and onto the banks (Murphy and Meehan 1991).

g. **Pool Frequency/Quality/Depth –** Pools are considered to be one of the most important habitat elements and are the preferred habitat type by most fish (Bestcha and Platts 1986), offering low velocity refuges, cooler stream temperatures during summer months, and overwintering habitat (Reeves et al.1991). In reference to spawning, pool tailouts, where gravel is deposited, are important areas for redd construction, and the pool bodies provide rearing habitat for juveniles and holding habitat for adults (Bjornn and Reiser 1991). Further, Sedell et al. (1990) describes pools as being important refuges from drought, fire, winter icing, and other disturbances. When pool numbers, volume, depth, and complexity increase, the stream's capacity to support a diversity of species and life stages increases (Bisson et al. 1992; Bjornn and Reiser 1991). In general, pool quality is directly related to increased surface area and depth, overhead cover (Fausch and Northcote 1992), presence of lwd, and undercut banks, especially in lower gradient streams. Further, pools of all shapes and sizes are needed to accommodate the various life history stages of fish, thereby allowing for juveniles to occupy pools absent of larger predatory fish (Bestcha and Platts 1986).

h. **Off-channel Habitat –** Off-channel habitats—comprised of alcoves, side channels, freshwater sloughs, wetlands or other seasonally or permanently flooded areas—are important rearing sites for juvenile fish (Roni et al. 2002). Roni et al. (2002) noted that most off channel habitat research focused on coho salmon, noting that juveniles are much more reliant on this habitat type for over-winter rearing and growth than other salmonids, such as cutthroat trout and Chinook salmon**.**

i. **Refugia –** Refugia, or designated areas providing high quality habitat, either currently or in the future, are a cornerstone of most species conservation strategies. Although fragmented areas of suitable habitat may be important, Moyle and Sato (1991) argue that to recover aquatic species, refugia should be focused at a watershed scale. Naiman et al. (1992) and Sheldon (1998) noted that past attempts to recover fish populations were unsuccessful because the problem was not approached from a watershed perspective. Noss et al. (1997) provides additional information, listing several principals that should be considered when evaluating reserves (refugia). First, refugia should be well distributed across a landscape, the idea being that widely distributed subpopulations will not experience catastrophic or adverse impacts across its entire range. Some subpopulations will escape the impact, eventually recolonize the affected area, and sustain the population as a whole. Second, large reserves are better than small ones, because there is a greater opportunity for habitat diversity and larger population size. As a result, genetic variability within a population will be optimized, promoting increased adaptability to environmental change. Thirdly, refugia that are closer together are better than those farther apart. A short distance between refugia promotes dispersion and genetic interchange. If enough interchange occurs between refugia, fish are functionally united into a larger population that can better avoid extinction.

j. **Floodplain Connectivity –** Leopold (1994) defines a floodplain as a level area near a river channel, constructed by the river in the present climate and overland flow during moderate flow events. When a stream can readily access its floodplain during high flow events, the stream will overflow its banks and spread across the floodplain, dissipating stream energy, depositing sediments, accessing side channels. Bestcha and Platts (1986) suggest that for a floodplain to be effective in sorting and capturing flood-born sediment it must have roughness elements, such as trees and other debris. Floodplains or riparian areas adjacent to stream channels serve as water storage sites—water collected from flooding and precipitation—which can increase subsurface flow to the stream channel (Elmore and Bestcha 1987), especially important to augmentation of low stream flows during summer months. Side channels associated with floodplains offer refuge areas to juvenile salmonids during high flow events (Roni et al. 2002).

k. **Streambank Condition –** Streambank condition is related to its ability to dissipate stream power. For many stream channels, riparian vegetation with woody root masses, along with instream debris, serve as physical barriers to erosive and downcutting forces of stream power (Bestcha and Platts 1986). Further, the stems of herbaceous and woody plants, residing on the stream bank, provide additional roughness to dissipate stream power and capture suspended sediments (Elmore and Bestcha 1987). When these roughness elements are removed, however, a streambank's ability to withstand stream power is decreased, resulting in bank erosion, relatively higher width to depth ratios, and possible channel incision. Even if steambanks are in good condition, increased peak flows can damage banks and cause channel incision. Finally, streambanks that are in good condition can provide quality fish habitat through undercut banks and overhanging vegetation (Bestcha and Platts 1986).

l. **Width to Depth Ratios –** The width to depth ratio is an index value that helps describe the shape of a stream channel, and is the ratio of bankfull width to mean bankfull depth (Rosgen 1996). Both measurements are based on bankfull flow or its indicators. In short, bankfull flow is the channel forming flow that transports the bulk of available sediment over time (Wolman and Miller 1960). In another way, bankfull flows are those that transport sediment from upstream reaches, forming and removing channel bars, doing the work that forms the morphological characteristics of a channel (Dunne and Leopold 1978). Relatively small width to depth values are indicative of stream stability, and Rosgen (1996) suggests that width to depth ratios can be used as a surrogate to stream stability. Finally, Bestcha and Platts (1986) state that as width to depth ratios increase, the stream becomes shallower and may result in a loss of pools.

m. **Increase in Drainage Network, Road Density and Location, and Change in Peak Base Flows –** Wemple et al. (1996) documented that 57% of a road system within a watershed, located in the western Cascades of Oregon, was hydrologically connected to the stream network by roadside ditches draining directly into streams and roadside ditches draining into relief culverts with gullies below their outlets.

Thus, an increase in road densities led to an associated increase in drainage density by up to 50%. High-density road systems have been linked to changes in the hydrograph or magnitude and timing of flow events. For instance, in an Oregon Coast Range watershed, Harr et al. (1975) showed that peak flows increased significantly after road building converted at least 12% of the area to road prisms. The causal affects were attributed to increased surface compaction, which reduces water infiltration, resulting in excess water being carried down the road, drainage ditches, and relief culverts into the stream network. Jones and Grant (1996) documented that peak flows increased by 50% in a watershed within a five year period following road construction and logging. The longevity of the hydrologic changes are as permanent as the roads, and until a road is removed and natural drainage patterns are restored, the road will continue to affect the routing of water through a watershed.

n. Disturbance Regime/History – Information for this section was acquired from Reeves et al. (1995). Even though the article was directed at anadromous salmonids, the discussion can readily apply to most PNW fish stocks. Riverine-riparian ecosystems within the PNW used by anadromous salmonids naturally experience periodic catastrophic disturbances, which then moved through a series of recovery states over a period of decades to centuries, resulting in a landscape that varies in suitability for salmonids. Disturbance can be categorized as being pulse or press disturbances. A pulse disturbance is one that allows an ecosystem to recover to predisturbance conditions, and a press disturbance is one that prohibits an ecosystem from rebounding to predisturbance conditions. The dominant pulse disturbances in which the PNW salmonids are adapted to include natural fire regimes, fire related landslides, and floods, all working in concert in a manner that produce habitat patches, varying in quality and quantity. In short, fires would burn through an area, landslides would then transport wood and sediment into the streams, and floods would distribute the sediment and debris throughout stream networks. In the Oregon coast range, the amount of sediment and large wood found in streams could be correlated to occurrence of the last stand replacement fire.

This pulse disturbance regime, or varying forms thereof, was altered with the onset of fire suppression and extensive timber harvest. The resulting effects are different from the natural pulse regime in that sediment is transported in the system without wood, the interval between disturbances has been drastically reduced in most cases, and harvest and road construction is widely distributed, resulting in chronic sedimentation across a larger landscape.

o. Riparian Areas – The following discussion was adapted from FEMAT (1993). Riparian areas are those portions of watersheds that are directly coupled to streams and rivers, the portions of watersheds required for maintaining hydrologic, geomorphic, an ecological processes that directly affect streams, stream processes, and fish habitats. The network of riparian reserves—comprised of all stream orders both intermittent and perennial—allow for connectivity of the aquatic ecosystem within a watershed. Riparian areas are shaped by disturbances characteristic of upland ecosystems, such as fire and windthrow, as well as disturbance processes unique to stream systems, such as lateral channel erosion, peakflow, deposition by floods and debris flows. The near-stream riparian areas—floodplains—may contain an increased diversity of plant species and extensive hydrologic nutrient cycling interactions between groundwater and riparian vegetation. This vegetation, ranging from conifers to deciduous hardwoods, provides allochthonous (organic debris) to stream channels and associated aquatic invertebrate communities. Further, riparian vegetation moderates light levels and stream temperature, helps armor streambanks with extensive root systems, and contributes large wood into the stream channel.

p. **Population Characteristics –** There are four key indicators of bull trout subpopulations that the USFWS considers important in evaluating subpopulation trends and the likelihood for species persistence at the watershed scale. Subpopulation size is evaluated relative to the habitat capacity and overall demographics (balanced representation of all life stages) to assess the reproductive potential of a subpopulation. Subpopulation growth and survival are evaluated to characterize the relative resilience and likelihood of recovery of a subpopulation from a disturbance that reduces the subpopulation size. The life history diversity (presence of migratory life history) and isolation characteristics of a subpopulation are evaluated to ensure the connectivity between adjacent subpopulations. Finally, subpopulation persistence and genetic integrity is evaluated by considering the risk of hybridization (gene introgression) and the previous assessments of subpopulation size, growth and survival, and life history diversity and isolation characteristics.

2. Causes of Degradation to Matrix Indicators

In 1991, the Endangered Species Committee of the American Fisheries Society identified 214 stocks of anadromous salmonids and trout in California, Idaho, Oregon, and Washington in need of special management considerations because of low or declining numbers (Nehlsen et al. 1991). Since that time, numerous salmonids were documented to be in such condition as to warrant their listing under the ESA in Oregon and Washington, including Coho salmon (2 ESU's), Chinook Salmon (6 ESU's), Chum salmon (2 ESU's), Sockeye salmon (2 ESU's), Steelhead (5 ESU's), Bull trout, and Lahonton cutthroat trout. Furthermore, non-salmonid species have experienced similar declines, resulting in ESA listings of the Modoc sucker, Warner Sucker, Shortnose sucker, Lost River sucker, Hutton tui chub, Borax Lake chub, and Oregon chub.

The declines in fish numbers can be directly related to the movement of matrix indicators from a predominately Properly Functioning rating to a Functioning-at-Risk or Functioning at Unacceptable Risk rating. The causes for this shift can be attributed, for the most part, to land use practices since Euro-American settlement in the 1850's. NMFS (1998) summarizes the major reasons for the declining numbers of Chinook salmon in an article entitled "*Factors Contributing to the Decline of Chinook Salmon: An Addendum to the 1996 West Coast Steelhead Factors for Decline*." The Chinook salmon on the west coast of the United States have experienced declines in abundance in the past several decades as a result of both natural and human factors. Forestry, agriculture, mining, and urbanization have simplified, degraded, and fragmented habitat. Water diversions for agriculture, flood control, domestic, and hydropower purposes have greatly reduced or eliminated historically accessible habitat. Chinook salmon face predation from native and nonnative fish, several species of birds, was well as marine mammals. Salmon have always experienced predation, but habitat alterations in many areas have tipped the predator/prey balance to favor predators. Increased water temperatures make salmon more susceptible to disease, which is exasperated during drought conditions. In an attempt to mitigate for lost habitat, extensive hatchery programs have been created to supplement a decrease in wild fish numbers. Competition, genetic introgression, and disease transmission resulting from hatchery introductions may significantly reduce the production and survival of native, naturally spawning Chinook salmon.

Likewise, the USDI (2002) provides similar reasons associated with the decline of Bull trout and include habitat degradation and fragmentation, the blockage of migratory corridors, poor water quality, angler harvest and poaching, entrainment (process by which aquatic organisms are pulled through a diversion or other device) into diversion channels and dams, and introduced nonnative species. Specific land and water management activities that depress bull trout populations and degrade habitat include dams and other diversion structures, forest management practices, livestock grazing, agriculture, agricultural diversions, road construction and maintenance, mining, and urban and commercial development.

Table 3 – *Documents that Describe Baseline Conditions in Oregon and Washington,* provide references that include site-specific detail as to the condition of matrix and pathway indicators throughout the programmatic area.

Table 3 - Documents that Describe Baseline Conditions in Oregon and Washington		
Aquatic	**Source/Reference**	**Programmatic Area or Sub-basin**
Biological Opinion for the Effects to Bull Trout from Continued Implementation of Land Resource Management Plans as Amended by the Interim Strategy for Managing Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, Western Montana, and Portions of Nevada (INFISH), and the Interim Strategy for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California (PACFISH)	U.S. Fish and Wildlife Service (Regions 1 and 6) August 14, 1998	Eastern Oregon and Washington
Programmatic Biological Opinion for the Implementation of the Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California (PACFISH)	NOAA Fisheries March 23, 1995	Eastern Oregon and Washington
Interior Columbia Basin Ecosystem Management Project: An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins Volume III	USDA Forest Service and Bureau of Land Management. June 1997	Eastern Oregon and Washington
Programmatic Biological Opinion – 15 Categories of Activities Requiring Department of Army Permits NMFS No. OSB2001-0016	NOAA Fisheries	Oregon
Programmatic Biological Opinion – Phase II Fish Passage Restoration Department of the Army Permits,	NOAA Fisheries NMFS No. WSB-01-197	Washington
Biological Opinion for the Malheur National Forest Grazing Program for FY 2002	NOAA Fisheries OHB2002-0135 August 26, 2002	Middle Fork and Upper John Day Sub-basins
Biological Opinion for Minerals Activities on Lands Administered by the Umatilla and Wallowa-Whitman National Forests, North Fork John Day River Sub-basin, Oregon, for FY 2002-2007	NOAA Fisheries 2000/01559 July 25, 2002	North Fork John Day Sub-basin
Biological Opinion for the Jones Creek Streambank Protection and Fish Habitat Improvement Project Wallowa County, Oregon (Corps. No. 1999-00284)	NOAA Fisheries 2002/00560 July 29, 2002	Wallowa River Sub-basin (Grande Ronde Basin)
Biological Opinion and Magnuson-Stevens Fishery Conservation Act Consultation for the Icicle Creek Restoration Project	NOAA Fisheries WSB-01-300 April 3, 2002	Wenatchee Sub-basin
Biological Opinion for the Foghorn Ditch Dredging Project in the Methow River Basin	NOAA Fisheries WSB-01-178 August 13, 2001	Methow Sub-basin
Washington State Conservation Commission's limiting factor reports for Water Resource Inventory Areas	Washington State Conservation Commission	State wide

3. **Matrix Indicators Adversely Affected by Programmatic Activities**
The matrix indicators represent elements necessary for quality fish habitat, all of which have been degraded to varying degrees throughout the PNW by the aforementioned factors of decline. The FS, FWS, and NOAA Fisheries representatives involved in the development of this BA chose to describe baseline conditions of the 50 programmatic sub-basins using those indicators that will be moved towards a "Degrade" effects call, resulting from programmatic activities. Those indicators are "Sediment/Turbidity," "Substrate," and "Physical Barriers," all of which may experience short-term adverse effects during project implementation but long-term benefits thereafter. In addition, the FS, FWS, and NOAA Fisheries representatives involved in the development of this BA decided to use "Sediment/Turbidity" as a surrogate indicator for all sediment related effects because information regarding "Substrate" was limited. A more detailed discussion as to the effects ("Degrade," "Maintain," "Restore") of programmatic activities on individual indicators can be found in Chapter V.
   a. **Sediment/Turbidity – Causes** – Timber management and associated road construction is the dominant land management activity on National Forest System lands and private and state timberlands that has contributed to stream sedimentation. On federally managed lands, roads contribute more sediment to streams than any other land management feature (FEMAT 1993; USDA and USDI 1997). On federal lands alone there are approximately 110,000 miles of roads with an estimated 250,000 stream crossings within the range of the northern spotted owl (FEMAT 1993) with an additional 100,678 miles of roads on Oregon and Washington National Forest administered lands that occur within the interior Columbia Basin assessment area (USDA and USDI 1997). The water collected and routed along a road prism and its ditches erode exposed soil particles and result in increased sedimentation into the stream network. Road construction and maintenance disturb soil layers on the road tread, ditch, and cutslope and are the primary sources of road related sediment. Further, road/stream crossings can be a major source of sediment when the crossings fail (USDA and USDI 1997). Most of the current stream crossings (usually culverts) have resulted in unnatural stream channel widths, slope, and streambed form up and downstream, and these alterations in channel morphology may persist for long periods of time (USDA and USDI 1997), the longevity being as permanent as the road (FEMAT 1993).

      Other land use practices that can lead to stream sedimentation include livestock grazing and agricultural practices. Livestock grazing can degrade fish habitat by removing riparian vegetation, destabilizing streambanks, widening stream channels, promoting incised channels, increased soil erosion, and degraded water quality (Platts 1981; Kauffman and Krueger 1984; Overton et al. 1993). Furthermore, agricultural practices, such as cultivation, lead to increased levels of sediment into nearby stream channels.

      Varying levels or sedimentation are occurring within the programmatic sub-basins. Table 4 - *Fourth Field Sub-basin Baseline Conditions – Sediment,* lists sub-basin baseline conditions relative to sediment. Sub-basin ratings for sediment were based on FWS (USDI 1998b) and NOAA Fisheries (NMFS 1996) criteria: PF - <12%

surface fines in gravel; FAR – 12-20% surface fines in gravel; FUR - >20% surface fines in gravel. For Oregon sub-basins, information to make ratings was acquired from Oregon Department of Fish and Wildlife Stream Surveys, which documented the "Average percent of sand, silt, and organics in surface substrate of all units." For Washington sub-basins, information was acquired from the Washington State Conservation Commission's limiting factor reports for Water Resource Inventory Areas (WRIA). The WRIA reports rated substrate fines according to FWS and NOAA Fisheries criteria. Further, additional information used to establish sub-basin baseline conditions was acquired from National Forest records and personnel from Oregon and Washington.

Table 4 - Fourth Field Sub-basin Baseline Conditions – Sediment

Properly Functioning	Functioning At-Risk	Functioning at Unacceptable Risk
Hood Canal (17110018)	Methow (17020008) Wenatchee (17020011) Imnaha (17060102) Mid. Col. Hood (17070105) Trout (17070307) Queets-Quinalt (17100102) Nooksack (17110004) Stillaquamish (17110008) Payallup (17110014) Nisqually (17110015) Pend Oreille (17010216) MF John Day (17070203) NF John Day (17070202) Hoh-Quillayute (17100101) Grays Harbor (1710105) Skykomish (17110009) Upper Skagit (17110005) Sauk (17110006) Skokomish (17110017) Dungeness-Elwha (17110020)	Upp.Col. Entiat (17020010) Upper Malheur (17050116) Burnt (17050202) Powder (17050203) Upp. Gran. Ron. (17060104) Wallowa (17060105) Low. Gran. Ron. (17060106) Walla Walla (17070102) Umatilla (17070103) Upp. John Day (17070201) Upper Deschutes (17070301) Low. Col.-Sandy (17080001) Lewis (17080002) Lower Chehalis (17100104) Warner Lakes (17120007) Alvord Lake (17120009) Williamson (18010201) Sprague (18010202) Upp. Klam. Lake (18010203)

Sediment information for the following sub-basins was not readily available: Yakima (17030001), Naches (17030002), Lower Snake-Asotin (17060103), Lower Snake-Tucannon (17060107), Little Deschutes (17070302), Lower Cowlitz (17080005), Lower Skagit (17110007), Snoqualmie (17110010), Duwamish (17110013), Lost (18010204). However, it can be assumed that these sub-basins are likely at the Functioning At-Risk or Functioning at Unacceptable Risk levels.

b. **Physical Barriers – Causes –** Undersized culverts not only contribute to increased sediment into stream channels but act as barriers to fish passage. From 2000 through 2002, the Region 6 FS took the first step in implementing a fish barrier removal program and inventoried approximately 80% of its culverts at road crossings on fish bearing streams. To date, across the 18 National Forests and one Scenic Area in Oregon and Washington, approximately 4,000 culverts were assessed, using a standardized protocol that documented or measured the following variables: culvert type, length, width, and height, culvert slope, channel alignment, pool depth at culvert outlet, jumping height to culvert outlet, and channel gradient. Of the measured culverts, about 80% pass adult salmon, 50% pass adult resident fish, and 20% pass juvenile fish.

   In combination with federal-land barriers, there are significant numbers of culvert barriers on non-federal lands throughout the states of Oregon and Washington, fragmenting habitats and fish populations even further. For example, in Washington, culvert barriers block over 7,700 river kilometers of historical salmon habitat used for adult spawning and juvenile rearing (Roni et al. 2002), and the situation in Oregon is likely to be similar in nature. Road crossing barriers usually result from installation of culverts that are undersized and placed at the wrong slope. This can lead to high flow velocities within the culvert and burdensome jumping heights at the culvert outlet, both of which may act as barriers to fish passage.

   In addition to habitat fragmentation related to culverts, agricultural practices, such as water diversions and dewatering of stream reaches for irrigation create migration barriers throughout Oregon and Washinton. For instance, in the current anadromous fish production areas of Oregon above Bonneville Dam, there are approximately 550 water diversions (USDA and USDI 1997). Even more, the larger hydroelectric, flood-control and irrigation dams contribute to the isolation of numerous resident fish populations and block historical habitat to both resident and anadromous salmonids.

   These baseline conditions regarding physical barriers are occurring within the 50 programmatic sub-basins. The following FWS (USDI 1998b) and NOAA Fisheries (NMFS 1996) criteria were used to establish ratings: PF – no human-made barriers regardless of flow; FAR – human-made barriers at low flow; FUR – human-made barriers that restrict fish movement at all flows. Based on these criteria, each of the 50 sub-basins are determined to be FUR. Region 6 FS culvert assessments and Washington State Conservation Commission’s limiting factor reports for Water Resource Inventory Areas were used to rate sub-basins.

V. Effects of the Programmatic Actions

A. Effects of Programmatic Actions on Matrix of Pathways and Indicators

The following describes the typical range of effects that are likely to occur from the programmatic actions to each of the matrix indicators. Effects to matrix indicators are displayed in Table 5. The FS, FWS, and NOAA Fisheries representatives assigned to assist with the development of this BA helped determined the ways in which indicators will be affected by the programmatic actions.

1. Effects to Temperature

For the temperature indicator, both the FWS (USDI 1998b) and NOAA Fisheries (NMFS 1996) Matrix of Pathways and Indicators suggest the use of temperature ranges to describe baseline conditions. Because only minimal amounts of stream-side vegetation are expected to be removed for culvert removals and replacements, changes in temperature are not expected; therefore, the effect of the programmatic actions on temperature is classified as "Maintain." This effect is expected to be consistent for all projects implemented under this BA. Refer to Table 5.

2. Effects to Sediment

For the sediment indicator, both the FWS (USDI 1998b) and NOAA Fisheries (NMFS 1996) Matrix of Pathways and Indicators suggest the use of percent fines in gravel to describe baseline conditions for a watershed. In addition, the NOAA Fisheries (NMFS 1996) directs that stream turbidity levels be used along with percent fines in gravel to describe baseline conditions. Short-term turbidity and sediment in gravels are expected to increase during culvert removals and replacements; therefore, the short-term effects of the programmatic actions on sediment and turbidity are expected to move the baseline condition towards a "Degrade" rating. However, because project related sediments will flush-out during high flow events and chronic inputs of sediment from an undersized culvert will be reversed, long-term effects of the programmatic actions will move the baseline towards a "Restore" rating. These effects are expected to be consistent for all projects implemented under this BA. Refer to Table 5.

3. Effects to Chemical Concentrations/Nutrients

Staging areas (used for construction equipment storage, vehicle storage, fueling, servicing, etc) will occur along existing roadways or turnouts beyond the 100-year floodprone area in a location and manner that will preclude erosion into or contamination of the stream or floodplain. Further, construction machinery will be cleaned and inspected for petroleum leaks before and during the project to minimize the risk of minor petroleum leaks. Therefore, the effect of the programmatic actions on this indicator is classified as "Maintain." This effect is expected to be consistent for all projects implemented under this BA. Refer to Table 5.

4. Effects to Physical Barriers

The intent of the programmatic activities are to restore fish passage for all native fish species and their life stages. During project implementation, however, water diversions may temporarily block up or downstream passage, thereby moving the baseline condition towards a short-term "Degrade" rating. After project completion, fish passage will be restored for all native fish and associated life stages. Therefore, the long-term effect of the programmatic actions will move the baseline towards a "Restore" rating. These effects are expected to be consistent for all projects implemented under this BA. Refer to Table 5.

5. **Effects to Substrate**
   As with the "Sediment" indicator, substrate embeddedness may increase during culvert removals and replacements; therefore, the short-term effects of the programmatic actions on substrate are expected to move the baseline condition towards a "Degrade" rating. However, because project related sediments will flush-out during high flow events and chronic inputs of sediment from an undersized culvert will be reversed, long-term effects of the programmatic actions will move the baseline towards a "Restore" rating. These effects are expected to be consistent for all projects implemented under this BA. Refer to Table 5.
6. **Effects to Large Woody Debris**
   Large wood may be temporarily moved within the project site to allow for movement of construction machinery. However, in such cases all large wood will be placed back or near to its original location once construction is completed. Because pieces of large wood per mile will not be changed, the effect of the programmatic actions on this indicator is classified as "Maintain." This effect is expected to be consistent for all projects implemented under this BA. Refer to Table 5.
7. **Effects to Pool Frequency, Character and Quality**
   Culvert removals and replacements will occur in an already disturbed site, not occupied by pools. However, the programmatic activities will eliminate any scour pool created by an undersized culvert. Given that the scour pools to be eliminated are "artificial" and limited in number along with the fact that project related sediment introduced into the stream channel will be minimized as to preclude a noticeable reduction in pool quality and depth, the effect of the programmatic actions on these indicators is classified as "Maintain." This effect is expected to be consistent for all projects implemented under this BA. Refer to Table 5.
8. **Effects to Off-channel Habitat**
   On occasions, where flood relief culverts are used in unconstrained floodplains, off-channel habitat may be restored. However, the restoration of off-channel habitat will be limited because only a portion of the programmatic activities may require flood culverts. Even though restoration may occur at the project level, it will not occur frequent enough to suggest that the programmatic activities will move a particular sub-basin to a restored condition; consequently, the effect of the programmatic actions on this indicator is classified as "Maintain." This effect is expected to be consistent for all projects implemented under this BA. Refer to Table 5.
9. **Effect to Refugia**
   The programmatic activities will increase connectivity between refugia. Therefore, effects of the programmatic actions will move baseline towards a "Restore" rating. This effect is expected to be consistent for all projects implemented under this BA. Refer to Table 5.
10. **Effects to Width/Depth Ratios**
   The programmatic activities will result in stream simulation projects that match bankfull width. However, culvert removals or replacements will likely have little or no influence on width/depth ratios throughout the associated stream. Other management

practices—high road densities and grazing—have a much greater influence on width/depth ratios. Consequently, the effect of the programmatic actions on this indicator is classified as "Maintain." This effect is expected to be consistent for all projects implemented under this BA. Refer to Table 5.

11. **Effects to Streambank Condition**
    As with the width/depth indicator, management activities other than culvert removals and replacements, such as high road densities and grazing, influence streambank condition. Therefore, the effect of the programmatic actions on this indicator is classified as "Maintain." This effect is expected to be consistent for all projects implemented under this BA. Refer to Table 5.
12. **Effects to Floodplain Connectivity**
    On occasions, where flood relief culverts are used in unconstrained floodplains, floodplain connectivity will be restored at the project level. However, the restoration of floodplain connectivity will be limited because only a portion of the programmatic activities may require flood relief culverts. Even though restoration will occur at the project level, it will not occur frequent enough to suggest that the programmatic activities will move a particular sub-basin towards a restored condition; consequently, the effect of the programmatic actions on this indicator is classified as "Maintain." This effect is expected to be consistent for all projects implemented under this BA. Refer to Table 5.
13. **Effects to Peak/Base Flows**
    Changes in peak/base flows are usually attributed to road densities and other management practices that significantly alter watershed hydrology. Because culvert removals and replacements do not alter watershed hydrology in a manner that changes the quantity and timing of flow, the effect of the programmatic actions on this indicator is classified as "Maintain." This effect is expected to be consistent for all projects implemented under this BA. Refer to Table 5.
14. **Effects to Drainage Network**
    The drainage network is related to road densities. Because culvert removals and replacements under this BA are not associated with road construction or decommissioning projects, the effect of the programmatic actions on this indicator is classified as "Maintain." This effect is expected to be consistent for all projects implemented under this BA. Refer to Table 5.
15. **Effects to Road Density and Location**
    Because culvert removals and replacements under this BA are not associated with road construction or decommissioning projects, the effect of the programmatic actions on this indicator is classified as "Maintain." This effect is expected to be consistent for all projects implemented under this BA. Refer to Table 5.
16. **Effects to Disturbance Regime/History**
    Stream simulation projects will greatly enhance sediment and large wood transport—a primary disturbance element—through road crossings: therefore, the effects of the programmatic actions on this indicator will help move the baseline towards a "Restore" rating. This effect is expected to be consistent for all projects implemented under this BA. Refer to Table 5.

17. **Effects to Riparian Reserves**
    Programmatic activities are expected to have an insignificant effect on riparian vegetation, the primary element being addressed under this indicator. Consequently, the effect of the programmatic actions on this indicator is classified as "Maintain." This effect is expected to be consistent for all projects implemented under this BA. Refer to Table 5.
18. **Effects to Subpopulation Size, Growth and Survival, Life History, Genetic Integrity**
    Stream simulation projects proposed under this BA will reestablish passage for all life stages of Bull trout, increase resiliency of subpopulations by reconnecting fragmented habitats within and amongst watersheds, help restore various life history patterns, and emphasize genetic integrity; therefore, the effect of the programmatic actions will help move the baseline towards a "Restore" rating. This effect is expected to be consistent for all projects implemented under this BA. Refer to Table 5.

Table 5 – Effects of Programmatic Actions to Matrix Indicators						
	Current Condition			**Effects of Action (s)**		
Relevant Indicators	**Properly Functioning**	**Functiong At Risk**	**Funct. At Unacceptable Risk.**	**Degrade ***	**Maintain**	**Restore ****
Water Quality						
Temperature	No change do to programmatic actions				X	
Sediment				ST-X***		LT-X****
Chemical Concen./Nutrients	No change do to programmatic actions				X	
Habitat Access						
Physical Barriers				ST-X		LT-X
Habitat Elements						
Substrate				ST-X		LT-X
Large Woody Debris	No change do to programmatic actions				X	
Pool Character and Quality	No change do to programmatic actions				X	
Off Channel Habitat					X	
Refugia						LT-X
Channel Cond. /Dynamics						
Width/Depth Ratios	No change do to programmatic actions				X	
Streambank Condition	No change do to programmatic actions				X	
Floodplain Connectivity	No change do to programmatic actions				X	
Flow/ Hydrolgy						
Changes in Peak/Base Flows	No change do to programmatic actions				X	
Drainage Network Increase	No change do to programmatic actions				X	
Watershed Conditions						
Road/Density/Locaiton	No change do to programmatic actions				X	
Distrubance history	No change do to programmatic actions				X	
Disturbance Regime/History	No change do to programmatic actions					LT-X
Riparian Reserves	No change do to programmatic actions				X	
Population Characacteristics						
Subpopulatain Size						LT-X
Growth and Survival						LT-X
Life History						LT-X
Genetic Integrity						LT-X

* Degrade – Refers to movement towards a degraded baseline condition

** Restore – Refers to movement towards a restored baseline conditon

*** ST-X – Short-term **** LT-X – Long-term.

B. Effects Associated with Construction Phases and Methods (Fish)

The following discussion displays the effects of each construction phase to ESA-listed fish. The FS, FWS, and NOAA Fisheries representatives designated to develop this BA assigned what they felt were conservative effect determinations. Most activities are considered to have only minor effects on Bull trout, Lost River sucker, Shortnose sucker, Warner sucker, Chinook and Chum salmon, and Steelhead trout. These effects generally come from the introduction of small amounts sediment, relative to watershed sediment budgets, into stream channels. Additional effects related to fish handling and construction activity are expected to occur to a lesser degree.

Table 6 lists the fish that may be present in the stream during project construction, depending on the area.

Table 6 - Fish Species Present During Barrier Removal

Fish Species	**Presence during Project Construction (In-water work periods)**			
	Spawning *	**Redd/Fry ****	**Juvenile**	**Adult (Resident, Migrating, or Holding)**
Bull trout	No	No	Yes	Yes
Lost River sucker	No	No	No	No
Shortnose sucker***	No	No	No (yes***)	No (yes***)
Warner sucker****	No	No	No	No
Lower Columbia River Chinook	No	No	Yes	Yes
Upper Columbia River Spring-Run Chinook	No	No	Yes	Yes
Puget Sound Chinook (Spring and Fall runs)	No	No	Yes (Spring-run) No (Fall-run)	Yes (Spring-run) No (Fall-run)
Snake River Fall-Run Chinook	No	No	No	No
Snake River Spring/Summer-Run Chinook	No	No	Yes	Yes
Columbia River Chum	No	No	No	No
Hood Canal Summer-Run Chum	No	No	No	No
Lower Columbia River Steelhead	No	No	Yes (Summer-run) Yes (Winter-run)	Yes (Summer-run) No (Winter-run)
Middle Columbia River Steelhead	No	No	Yes (Summer-run) Yes (Winter-run)	Yes (Summer-run) No (Winter-run)
Upper Columiba River Steelhead	No	No	Yes (Summer-run) Yes (Winter-run)	Yes (Summer-run) No (Winter-run)
Snake River Basin Steelhead	No	No	Yes	Yes

*State in-water work periods are tailored to avoid spawning times of fish ** State in-water work periods are established to prevent work prior to emergence. *** The Shortnose sucker may exhibit stream life history forms in limited areas. ****The Warner sucker has stream life history forms, but adults or juveniles are not expected to occur on National Forest lands; however project implementation may have effects on critical habitat occurring downstream of National Forest lands.

1. **Site Preparation – Effects to Fish**
   Because construction activity will occur in the staging and associated stockpile areas, located outside of the 100-year floodplain, very little activity is expected to occur in the riparian area, and no activity is expected in the stream channel. Further, sediment barriers will be placed along disturbed sites, where necessary, to prevent potential erosion/sedimentation into a stream channel. Therefore, it is highly unlikely that fish species will be disturbed during this construction phase.

   These effects are expected to be similar for all programmatic activities within confined and unconfined stream types, and the following conservation measures outlined in Chapter II are designed to minimize effects: #3. Pollution and Erosion Control Plan (PECP) and Supporting Measures, subsections c. Minimize Site Preparation Impacts; d. Minimize Heavy Equipment Fuel/Oil Leakage; e. Minimize Earthmoving Related Erosion.
2. **Excavate Road Fill above Wetted Perimeter – Effects to Fish**
   Construction activities will move from the staging and stockpile areas to the road crossing. Road fill excavation may temporarily disturb fish residing in the immediate area —encouraging up or downstream movement. In addition, when construction machinery crosses the stream at designated locations, fish may be temporarily displaced by equipment or a short-term increase in turbidity. Removal of riparian vegetation is expected to be so minimal as to have insignificant effects to floodplain, riparian, and fish habitat functions.

   These effects are expected to be similar for culvert removal and replacement activities within confined and unconfined stream types, and the following conservation measures outlined in Chapter II are designed to minimize effects: #1. In-Water Work Windows; #3. PECP and Supporting Measures, subsections a. Follow State Water Quality Guidelines; b. Spill Prevention and Containment Plan (SPCCP); d. Minimize Heavy Equipment Fuel/Oil Leakage; e. Minimize Earthmoving Related Erosion; f. Minimize Stream Crossing Sedimentation.
3. **Isolate Construction from Stream Flow – Effects to Fish**
   The capture, transport, and release of ESA-listed fish, if needed, will cause short-term stress and occaisional mortality. Effects of stocking captured fish into a new upstream habitat may lead to competitive interactions with fish residing at the site and in some cases can lead to predation on the disoriented fish being released. Because Bull trout have resident-stream life history forms, both juvenile and adults could experience short-term stress or occaisional mortality. It is unlikely that Warner, Lost River and Shortnose suckers—juveniles and adults—will be present in the stream during project construction; therefore, these fish should not experience stress or mortality. Both juvenile and adult stages of steelhead and spring/summer-run chinook salmon may be subjected to short-term stress, but most likely only juveniles would be handled and subject to possible mortality. It is highly unlikely that Chum or fall-run chinook salmon (Puget Sound and Snake)—juveniles and adults—will be present in the stream during project activities; therefore, these fish should not experience stress or mortality.

The construciton of a temporary access road through the riparian zone to the stream's edge, in preparation for construction of a diversion dam will remove riparian vegetation. However, the amount of vegetation removed is expected to be minimal and have insignificant effects to aquatic or riparian functions. The dewatered site will temporarily reduce the amount of habitat available to fish, and the diversion structure may temporarily block fish passage. In many cases, the diversion structure will act as a continuation of the barrier presented by the road crossing; therefore, in such cases the diversion structure is not expected to cause any additional adverse impacts to upstream movement of ESA-listed fish. Juvenile fish, which may have hid and stayed in the channel substrate during fish capture and transport, will likely suffer mortaility upon dewatering.

These impacts are expected to be similar for culvert removal and replacement and post-project construction activities (described in Chapter II construction methods) within confined and unconfined stream types, and the following conservation measures outlined in Chapter II are designed to minimize effects: #1. In-Water Work Windows, #2. Fish Handling and Transfer Protocols, and #3. PECP and Supporting Measures, subsections a. Follow State Water Quality Guidelines; b SPCCP; d. Minimize Heavy Equipment Fuel/Oil Leakage; e. Minimize Earthmoving Related Erosion; f. Minimize Stream Crossing Sedimentation; g. Minimize Sedimentation through Dewatering.

4. **Remove Impassible Culvert and Excavate Channel Substrate – Effects to Fish**
   Fill material being excavated to access and remove the existing culvert followed by excavation of the channel bed may lead to minor sediment spills into the dewatered stream channel. Becasue all actions will be occurring within a dewaterd area, there should be no immediate effects to fish species. However, the following conservataion measures described in Chapter II will be implemented to minimize the amounts of sediments introducted into the stream channel, which can later be be transported during flow restoration: #1. In-Water Work Windows and #3. PECP and Supporting Measures, subsections a. Follow State Water Quality Guidelines; b SPCCP; d. Minimize Heavy Equipment Fuel/Oil Leakage; e. Minimize Earthmoving Related Erosion; f. Minimize Stream Crossing Sedimentation; g. Minimize Sedimentation through Dewatering.
5. **Construct Fish Passage Structure, Replace Backfill, and Embed Structure – Effects to Fish**
   a. **Culvert Removal and Floodplain Restoration**
      Becasue all actions will be occuring within a dewaterd area, there should be no immediate effects to fish species. However, the following conservataion measures described in Chapter II will be implemented to minimize the amounts of sediments introducted into the stream channel, which can later be be transported during flow restoraiton: #1. In-Water Work Windows and #3. PECP and Supporting Measures, subsections a. Follow State Water Quality Guidelines; b SPCCP; d. Minimize Heavy Equipment Fuel/Oil Leakage; e. Minimize Earthmoving Related Erosion; f. Minimize Stream Crossing Sedimentation; g. Minimize Sedimentation through Dewatering.

b. **Culvert removal followed by replacement by a culvert, opem-bottomed arch, or bridge**
   Becasue all actions will be occuring within a dewaterd area, there should be no immediate effects to fish species. However, the following conservataion measures described in Chapter II will be implemented to minimize the amounts of sediments introducted into the stream channel, which can later be be transported during flow restoraiton: #1. In-Water Work Windows and #3. PECP and Supporting Measures, subsections a. Follow State Water Quality Guidelines; b SPCCP; d. Minimize Heavy Equipment Fuel/Oil Leakage; e. Minimize Earthmoving Related Erosion; f. Minimize Stream Crossing Sedimentation; g. Minimize Sedimentation through Dewatering.

6. **Remove Diversion and Restore Stream Flow – Effects to Fish**
   When construction is completed and the diversion dam is removed, flow will be restored through the project site, capturing and transporting sediment introduced into the channel from previous construction phases. Flow will be slowly restored to the site to prevent loss of surface water downstream as the construction site streambed absorbs the water. The slow reintroduction of water will decrease the intensity of stream turbidity, as well. The sediment plume will likely be limited to the immediate vicinity (approximately ¼ mile downstream) and should dissipate within a few hours. In general, introduced sediments, resulting from the previous construction phases, will result in approximately one to three cubic-yards (and on rare occasions up to five cubic yards) of fine sediments introduced into the stream channel. The increased stream turbidity may deposit fine coats of sediment on channel substrate a short distance downstream, encourage fish to move downstream, and alter behavior patterns for a short time. Because the work will be conductued during the in-water work periods (a time when spawning is not expected and after emergence of fry), the project should not interfer with spawning, egg development, and the sac fry life stage. In cases of fall-spawning fish, the fine layer of sediment deposited on channel substrate will be cleared away as these fish construct their redds. It is anticipated that all project related sediment will be flushed out during the fall/winter/spring high flows after project completion; therefore, long-term impacts to spawning gravels are not expected. Further, the project related sediments introduced into the stream channel are minimal, if not insignificant, relative to the annual sediment budget of a watershed, supporting the conclusion that long-term sediment/turbity impacts will not occur. From this point on, fish passage should be restored for all native fish species and associated life stages.

   Effects are expected to be similar for all culvert removal and replacement programmatic activities within confined and unconfined stream types, and the following conservation measures outlined in Chapter II are designed to minimize effects: #1. In-Water Work Windows and #3. PECP and Supporting Measures, subsections a. Follow State Water Quality Guidelines; b SPCCP; d. Minimize Heavy Equipment Fuel/Oil Leakage; e. Minimize Earthmoving Related Erosion; f. Minimize Stream Crossing Sedimentation; h. Flow Reintroduction.

7. **Backfill to Road Surface – Effects to Fish**
   Road fill placement with heavy machinery may temporarily disturb fish residing in the immediate area —encouraging up or downstream movement. This action should not result in fish mortality, and such an impact is expected to be similar for all culvert replacement projects within confined and unconfined stream types. The following conservation measures outlined in Chapter II are designed to minimize effects:#1. In-Water Work Windows (when necessary) #3. PECP and Supporting Measures, subsections a. Follow State Water Quality Guidelines; b SPCCP; d. Minimize Heavy Equipment Fuel/Oil Leakage; e. Minimize Earthmoving Related Erosion; f. Minimize Stream Crossing Sedimentation.
8. **Site Restoration – Effects to Fish**
   Most site restoration activities will occur outside of the stream channel, with limited activity in riparian areas, such as decompaction of access roads followed by seeding and planting. Most site resotration activies will likely occur in the staging and stockpile areas, away from the stream and riparian zones. Therefore, it is unilkely that fish species will encounter distubance during this construction phase. Effects are expected to be similar for all programatic activities within confined and unconfined stream types, and the following conservation measures outlined in Chapter II are designed to minimize effects: #1. In-Water Work Windows (when necessary); #3. PECP and Supporting Measures, subsections a. Meet State Water Quality Guidelines; b. Pollution and Erosion Control Plan (PECP); c. Minimize Heavy Equipment Fuel/Oil Leakage; d. Minimize Stream Crossing Sedimentation; e. Minimize Earthmoving Related Erosion; j. Site Restoration.
9. **Maintenance – Effects to Fish**
   Heavy machinery, used to access and remove large wood at the road crossing inlet, may disturb fish residing in the immediate vicinity, encouraging up or downstream movement. On occaisions, when machinery may have to cross a stream channel to remove, transport, or place large wood, fish may be temporarily displaced by equipment or a short-term increase in turbidity. Removal of riparian vegetation is expected to be so minimal as to have insignificant effects to floodplain, riparian, and fish habitat functions.

   Maintenance activities are expected to be infrequent, usually after 100-year flow events. The effects are expected to be similar for all programmatic activities within confined and unconfined stream types, and the following conservation measures outlined in Chapter II are designed to minimize effects: #1. In-Water Work Windows; #3. PECP and Supporting Measures, subsections a. Follow State Water Quality Guidelines; b. Spill Prevention and Containment Plan (SPCCP); c. Minimize Site Preparation Impacts; d. Minimize Heavy Equipment Fuel/Oil Leakage; e. Minimize Earthmoving Related Erosion; f. Minimize Stream Crossing Sedimentation; j. Site Restoration.

10. Post Project Construction (Restoration of Streambed Embeddedness) and Effects to Fish

Effects and conservation measures are the same as those described in "1. Site Preparation," "3. Isolate Construction from Stream Flow and Effects to Fish Species," the embed portion of "5. Construct Fish Passage Structure, Replace Backfill, and Embed Structure," "6**.** Remove Diversion and Restore Stream Flow and Effects to Fish Species," and "8. Site Restoration and Effects to Fish Species."

C. Effects to Birds, Mammals, Plants and Critical Habitat

Project Design Criteria are measures applied to project design and implementation by the action agency, and are designed to minimize the potential detrimental effects to listed and proposed threatened and endangered species or critical habitat. The following criteria are **mandatory** in order for the "not likely to adversely affect" determinations made for projects included in this Biological Assessment to be valid. If these criteria cannot be met, **then the project falls outside the scope of this programmatic consultation, and a separate formal Section 7 consultation must be initiated for the project.**

The northern spotted owl and marbled murrelet are the only species for which "may affect, likely to adversely affect" determinations have been made due to potential harassment effects of some fish passage improvement projects that will be implemented during periods associated with nesting. The project design criteria identified below should be applied to the extent possible to minimize adverse effects for these species. When projects are implemented during the seasonal restriction periods and known sites and/or potential habitat may be adversely affected, this must be documented to determine the amount of "incidental take" associated with the project. If this level is exceeded**,** Section 7 consultation must be reinitiated. This process is described in further detail in the following sections for these species.

1. Birds

a. Bald Eagle – In Oregon and Washington, the bald eagle nesting period can begin as early as January 1, and may extend until August 31. During this time, bald eagles are sensitive to human disturbance, particularly within the sight distance of nest sites. Disturbance can result in a number of situations that can impact nesting behavior and result in the subsequent mortality of young. Winter roost areas are critical to bald eagles for protection from inclement weather conditions in forest stands with favorable microclimate conditions that are located in areas with access for sources of food (such as anadromous fish runs, high concentrations of waterfowl, or mammalian carrion).

The proposed projects in this BA are unlikely to result in removal of bald eagle nest or roost trees, or suitable habitat, because most construction activities will occur in the road prism, and generally less than 1 acre will be impacted for site preparation. The potential impacts are primarily related to disturbance from equipment and activity in close proximity to nest or roost sites. Implementation of the following project design criteria will result in a "may affect, not likely to adversely affect" determination for the bald eagle.

BE1: No known bald eagle nest trees, perch trees, or roost trees will be felled or modified.
BE2: Suitable bald eagle habitat will not be removed within 0.25 miles (approximately 400 meters) of nest or roost sites.
BE3: Potential eagle perches (large snags, dead top trees or other suitable sites) within 0.5 mile (800 meters) of nests or roosts will not be felled.
BE4: Work activities will not take place within 0.25 mile (approximately 400 meters) of active nests/roosts, or within 0.5-mile (approximately 400 meters) line-of-sight from nests/roosts during periods of eagle use, unless surveys demonstrate that the nest or roost is not being used. Critical nesting periods generally fall between 1 January and 31 August.
BE5: Key wintering areas will be protected from disturbance from approximately 15 November to 15 March.
BE6: Meet direction in Forest or District draft or final site management plans for eagle nest or roost sites.

b. **Marbled Murrelet/Designated Critical Habitat –** Potential effects of the fish passage restoration projects on the marbled murrelet are associated with disturbance associated with activities that would occur during the critical nesting period from April 1 through August 6. Most projects will be scheduled outside of this period due to work windows that minimize impacts on fish, but it is expected that some projects will occur during the nesting period that may adversely affect murrelets.

Harassment could occur if (1) noise interrupts and/or precludes essential nesting and feeding behaviors, (2) noise/visual stimuli is in such close proximity to the nest that the activity is perceived as a threat and causes flushing from the nest or missed feedings, or (3) noise is loud and sudden which causes flushing from a nest (USDI 2002). Effects of harassment on murrelets could result in reduced reproduction or mortality of young due to avoidance of an area for nesting, adults flushing from the nest, increased susceptibility to predation, aborted feeding of young, nest abandonment, and premature fledging.

Adverse effects on marbled murrelet suitable or potential habitat, or designated critical habitat, are not expected to occur because most construction activities will occur in the road prism where vegetation has been previously altered or removed, and generally less than 1 acre will be impacted for site preparation. If suitable or potential habitat is removed, the project falls outside the scope of this BA, and consultation must be initiated separately to address those effects.

Application of the following design criteria for projects occurring within the range of the marbled murrelet on the Mt. Baker-Snoqualmie, Olympic, and Gifford Pinchot NFs will result in a “may affect, not likely to adversely affect” determination.

MM1: No suitable or potential marbled murrelet habitat is removed.

MM2: The project is implemented between August 6 and September 15, and noise-disturbing activities do not occur during the periods when chicks are being fed (2 hours after sunrise and 2 hours before sunset).
MM3: The project is implemented between April 1 and August 6 but it is located farther than 75 yards from a known occupied site, or unsurveyed suitable or potential marbled murrelet habitat if noise will be above ambient levels, OR is farther than 120 yards if helicopters will be used, OR is farther than 270 yards if blasting will occur.
MM4: No more than 1 acre of forested areas defined as a primary constituent element of marbled murrelet critical habitat is removed.
MM5: Garbage containing food and food trash generated by workers in project areas is secured or removed to minimize attraction of corvids, which have been identified as predators of murrelet eggs and young.

For the **Mt. Baker-Snoqualmie and Olympic NFs**, an estimated 10 projects per year over the 5-year period covered by this Biological Assessment "may affect, and are likely to adversely affect" the marbled murrelet because of harassment effects due to implementation during the early nesting period from April 1 until August 6. The majority of these projects will generate noise above ambient levels from use of heavy equipment (excavators, bulldozers, and front-end loaders). It is estimated that one of the 10 projects each year will generate higher noise/disturbance levels associated with helicopters, pile drivers or blasting. For the **Gifford Pinchot NF**, where less of the Forest is within the range of the species, an estimated 5 projects per year "may affect, and are likely to adversely affect" the murrelet due to harassment, and one of these projects per year will involve higher noise/disturbance levels.

The following is an estimated total number of acres of suitable or potential habitat on each Forest that may be adversely affected by harassment related to project activities over the 5-year period covered by this Biological Assessment, assuming 4 acres/project (within 75 yards) may be affected by noise above ambient levels associated with heavy equipment use, and up to 50 acres/project (within 270 yards) may be affected by helicopter or pile driver use or blasting. The assumptions and process used to assess harassment and derive acre estimates were taken from USDI Fish and Wildlife Service, Western Washington Fish and Wildlife Office. 2002. Biological Opinion of the Effects of Mt. Baker Snoqualmie National Forest Program Activities for 2003-2007 on Marbled Murrelets and Northern Spotted Owls. FWS Reference Number 1-3-02-F-1583. Prepared by Kent Livezey, Cindy Levy, and Mark Hodgkins.

> **Mt. Baker-Snoqualmie NF**: 430 acres (annual maximum 132 acres)
> **Olympic NF**: 430 acres (annual maximum 132 acres)
> **Gifford Pinchot NF**: 330 acres (annual maximum 112 acres)

If a project may affect suitable or potential habitat due to harassment, each Forest must document the estimated number of acres on an **annual** basis. If the number of acres exceeds the "annual maximum" identified above, then consultation must be reinitiated. The annual maximum was estimated to allow the possibility of more than one project with higher noise/disturbance levels per year, or a higher number than the estimated number of projects with lower disturbance levels in a year.

c. **Northern Spotted Owl/Designated Critical Habitat –** Potential effects of the fish passage restoration projects on the northern spotted owl are associated with disturbance associated with activities that would occur during the nesting season. In Washington, the critical period occurs from March 1 through July 15. In Oregon for the Fremont-Winema NF the period is from March 1 through August 15. The nesting period observed on the Deschutes NF is from March 1 through September 30, since data on fledging dates is not available. Although many of the projects will be scheduled outside of this period due to work windows that minimize impacts on fish, it is expected that some projects will occur during the nesting period that may adversely affect owls.

Harassment for owls is similar to that for marbled murrelets, and could occur if (1) noise interrupts and/or precludes essential nesting and feeding behaviors, (2) noise/visual stimuli is in such close proximity to the next that the activity is perceived as a threat and causes flushing from the nest or missed feedings, or (3) noise is loud and sudden which causes flushing from a nest (USDI 2002). Effects of harassment on spotted owls could result in reduced reproduction or mortality of young due to avoidance of an area for nesting, adults flushing from the nest, increased susceptibility to predation, aborted feeding of young, nest abandonment, and premature fledging.

Adverse effects on spotted owl suitable habitat, or designated critical habitat, are not expected to occur because most construction activities will occur in the road prism, and generally less than 1 acre will be impacted for site preparation. If occupied or unsurveyed suitable or potential habitat is removed, the project falls outside the scope of this BA, and consultation must be initiated separately to address those effects.

Criteria NS01 and NS02 may be waived in a particular year if nesting or reproductive success surveys conducted according to spotted owl survey guidelines reveal that spotted owls are non-nesting or that no young are present that year. Waivers are valid only until March 1 of the following year. Previously known sites/activity centers are assumed occupied unless protocol surveys indicate otherwise.

The following project design criteria will result in a “may affect, not likely to adversely affect” determination for the northern spotted owl.

NSO1: If an active spotted owl nest or activity center is located within or adjacent to a project area, delay the project activity until September 30 or until it is determined that young are not present. (For a given situation, the “adjacent distance” is determined by the action agency biologist-- if needed, contact the

Level 1 team for guidance. At a minimum, if an activity could cause a roosting spotted owl to flush, it is considered "adjacent".)
NSO2: Project associated work activities that produce noise above ambient level, will not occur within 75 yards of any nest site or activity center of known pairs and resident singles (or unsurveyed suitable habitat) between March 1 and July 15 in Washington and between March 1 and September 30 in Oregon. The restricted zone during these periods extends to 120 yards for helicopter use, and 270 yards for blasting. March 1 – June 30 is considered the critical early nesting period; the action agency biologist has the option to extend the restricted season based on site-specific information (such as a late or recycle nesting attempt).
NSO3: No more than 1-acre of suitable or dispersal habitat may be degraded, per project, within critical habitat.

For the **Mt. Baker-Snoqualmie, Olympic, and Gifford Pinchot NFs**, an estimated 10 projects per year over the 5-year period covered by this Biological Assessment "may affect, and are likely to adversely affect" the northern spotted owl because of harassment effects due to implementation during the nesting period (adverse effects could occur March 1 through July 15 in Washington, March 1 through September 30 in Oregon). The majority of these projects will generate noise above ambient levels from use of heavy equipment (excavators, bulldozers, and front-end loaders). It is estimated that one of the 10 projects each year will generate higher noise/disturbance levels associated with helicopters, pile drivers or blasting. For the **Okanogan-Wenatchee NF,** which has less overall area within the range of the owl, an estimated 5 projects per year "may affect, and are likely to adversely affect" the owl due to harassment, and one of these projects per year will involve higher noise levels. For the **Fremont-Winema NF and Deschutes NF** in Oregon**,** which also have less overall area within the range of the owl but have a longer period when disturbance is considered an adverse effect, an estimated 6 projects per year for the **Fremont-Winema NF** and 7 projects per year for the **Deschutes NF** "may affect, and are likely to adversely affect" the owl due to harassment, and one of these projects per year will involve higher noise levels.

The following is an estimated total number of acres of owl suitable habitat on each Forest that may be adversely affected by harassment related to project activities over the 5-year period covered by this Biological Assessment, assuming 4 acres/project (within 75 yards) may be affected by noise above ambient levels, and up to 50 acres/project (within 270 yards) may be affected by helicopter use or blasting. The assumptions and process used to assess harassment and derive acre estimates were taken from USDI Fish and Wildlife Service, Western Washington Fish and Wildlife Office. 2002. Biological Opinion of the Effects of Mt. Baker Snoqualmie National Forest Program Activities for 2003-2007 on Marbled Murrelets and Northern Spotted Owls. FWS Reference Number 1-3-02-F-1583. Prepared by Kent Livezey, Cindy Levy, and Mark Hodgkins.

Mt. Baker-Snoqualmie NF – 430 acres (annual maximum 132 acres)
Olympic NF – 430 acres (annual maximum 132 acres)

Gifford Pinchot NF – 430 acres (annual maximum 132 acres)
Okanogan-Wenatchee NF – 330 acres (annual maximum 112 acres)
Deschutes NF – 370 acres (annual maximum 120 acres)
Winema NF – 350 acres (annual maximum 116 acres)

If a project may affect suitable habitat due to harassment, each Forest must document the estimated number of acres on an **annual** basis. If the number of acres exceeds the "annual maximum" identified above, then consultation must be reinitiated. The annual maximum was estimated to allow the possibility of more than one project with higher noise/disturbance levels per year, or a higher number than the estimated number of projects with lower disturbance levels in a year

2. **Mammals**
   a. **Canada Lynx –** The primary potential effects on lynx from the fish passage improvement projects are associated with disturbance. Most construction activities will occur in the road prism where vegetation has been previous degraded or removed. Information in the Lynx Conservation and Assessment Strategy (Ruediger et al. 2000) was used to evaluate potential effects on lynx. Activities may temporarily displace lynx if they are present in proximity to project areas when activities are occurring.

      To date, most investigations of lynx have not shown human presence to influence how lynx use the landscape (Aubry et al. 2000). There have been no studies designed to determine the effects of human disturbance on lynx. Studies that have been conducted have reported anecdotal observations regarding lynx apparent tolerance of human presence. Several studies of lynx in the taiga have been conducted in areas of relatively dense rural human populations and agricultural development, suggesting that lynx can tolerate moderate levels of human disturbance. An exception to this may be activities around a den site that may cause abandonment of the site, possibly affecting kitten survival (Ruggerio et al. 2000). Current research indicates lynx may tolerate limited disturbance, even around active dens, but the level of tolerance is unknown.

      Projects "may affect, but are not likely to adversely affect" lynx if the following design criteria are incorporated:

      CL1: No active lynx dens are located within 270 yards (based on sight distance and attenuation of sound in forested environments of a project.
      CL2: No suitable habitat will be degraded or removed.
      CL3: The project will not result in increased off-road vehicle access to lynx habitat during or following implementation.
   b. **Gray Wolf –** Gray wolves are currently rare throughout most of the area where the fish passage improvement projects will be implemented, and it is unlikely locations will directly impact any animals or active den sites. Projects will be of relatively short duration, and should not affect prey availability or wolves if animals are present in the area. Therefore, the determination of "may affect, but not likely to adversely affect" is appropriate for this species if the following is considered.

GW1: No active den or rendezvous site or pack activity is located within 1.5-miles of the project (Chapman 1979).

If an active den, rendezvous site, or pack activity if identified, the project would fall outside the scope of this Biological Assessment, and a separate consultation would be required to address potential effects.

c. **Grizzly Bear** – Potential effects of the projects on grizzly bears include habitat loss and disturbance. However, the amount of habitat removal or degradation near fish passage improvement activities is expected to be minimal (less than 1 acre for any project). Proposed activities may temporarily displace grizzly bears or result in short-term degradation of riparian area. Work will not occur in areas that may affect bears during sensitive time period when animals could be present. Therefore, with implementation of following project design criteria to avoid or minimize effects, the activities may affect, but are not likely to adversely affect the grizzly bear.

GB1: Projects generating noise above ambient levels within ¼ mile (1 mile for blasting) of any known grizzly bear den site will not occur from October 15 through May 15
GB2: Projects generating noise above ambient levels and located within ¼ mile (1.0 mile for blasting) of early season grizzly bear foraging areas (e.g., low elevation grass/forb habitat, deciduous forest, riparian forest, shrub fields, montane meadows, avalanche chutes) will not occur from March 15 to July 15 if the activity will last for more than one day.
GB3: Projects generating noise above ambient levels and located within ¼ mile (1.0 mile for blasting) of late season grizzly bear foraging areas [e.g., high elevation berry fields, shrub fields, fruit/nut sources, wet forest openings, alpine and subalpine meadows, montane meadows (moist, cool, upland slopes dominated by coniferous trees)] will not occur from July 16 to November 15 if the activity will last for more than one day.
GB4: Projects will not increase trail or road densities within grizzly bear core habitat. No road or trail construction or reconstruction will occur in recovery areas.
GB5: All attractants, including food and garbage, will be stored in a manner unavailable to wildlife at all times.

d. **Woodland Caribou –** Potential effects of the proposed action on woodland caribou include habitat loss and disturbance. However, the amount of habitat removal or degradation near project sites in the caribou recovery area in the Selkirk Mountains is expected to be minimal. Proposed activities may temporarily displace caribou or result in short-term degradation of riparian areas in caribou habitat. Direct mortality or sub-lethal effects are unlikely. Work will not occur in sensitive areas identified by the local wildlife biologist. Implementation of the projects as described in this BA "may affect, but are not likely to adversely affect the woodland caribou if the following design criteria are applied to avoid or minimize impacts to woodland caribou:

WC1: Projects that are scheduled during early winter in the caribou recovery area (Michael Borysewicz pers. com.2003) and generate noise above ambient levels will be evaluated by the local wildlife biologist to determine if there will be disturbance effects to caribou.

WC2: Any vegetation management will not affect more than 1.0 acre of native forest per year.

WC3: Projects will not result in increased off-road vehicle access to caribou habitat.

3. Plants

a. **Howell's Spectacular Thelypody** (*Thelypodium howellii spectabilis*) – Due to the narrow range of this species in Eastern Oregon, the only area included in this BA where Howell's spectacular thelypody is suspected to occur is in mesic, alkaline meadow habitats with pluvial-deposited alkaline clay soils on the Wallowa-Whitman NF. Proposed fish passage improvement projects located in the vicinity of suitable habitat may affect, but are not likely to adversely affect this species with the implementation of the design criteria described below.

b. **MacFarlane's Four-O'clock** (*Mirabilis macfarlanei*) – *Mirabilis macfarlanei* is known to occur in three geographically isolated units in Oregon and Idaho, and one these areas is located within the area covered by this BA on the Wallowa-Whitman NF. The species generally occurs on open, steep talus slopes within canyon land corridors. Fish habitat improvement projects implemented on this Forest may affect, but are not likely to adversely affect the species with incorporation of the design criteria described below.

c. **Marsh Sandwort** (*Arenaria paludicola*) – *Arenaria paludicola* historically occurred in freshwater wetlands that could be affected by the types of activities associated with the proposed fish passage improvement projects if hydrological conditions are altered. However, this species has not been documented on any of the Forests where the projects will occur; it is suspected to occur on the Olympic NF based on the presence of suitable habitat. The last documented collection of this rare plant was near Tacoma Washington in 1896. With implementation of the project design criteria described below, the proposed fish passage improvement projects may affect, but are not likely to adversely affect this species.

d. **Showy Stickseed** (*Hackelia venusta*) – Showy stickseed has a very narrow range and is restricted to one small population in Chelan County, Washington on the Okanogan-Wenatchee National Forest. Proposed fish passage improvement projects located in the vicinity of this area may affect, but are not likely to adversely this species with the implementation of the design criteria described below.

e. **Spalding's Catchfly** (*Silene spaldingii*) – *Silene spaldingii* is primarily restricted to mesic prairie or steppe vegetation in the Palouse region. For the area covered by this BA, it has been documented on the Umatilla and Wallow-Whitman NFs and is unlikely to occur in other areas. Proposed fish passage improvement projects located in the vicinity of suitable habitat may affect, but are not likely to adversely affect this species with the implementation of the design criteria described below.

f. **Ute Ladies'-Tresses** (*Spiranthes diluvialis*) – *Spiranthes diluvialis* occurs in Okanogan and Chelan Counties in Washington State, but has not been documented on federal land. It may occur on the Okanogan-Wenatchee NF and Wallowa-Whitman NF based on the presence of suitable habitat, which consists of mesic or wet meadows near spring, lakes, or perennial streams. The primary effect on this orchid from projects described in this BA would be alteration of hydrological conditions. Proposed fish passage improvement projects located in the vicinity of suitable habitat may affect, but are not likely to adversely affect this species with the implementation of the design criteria described below

g. **Water Howellia** (*Howellia aquatilis*) – Water howellia is an aquatic plant that is restricted to small vernal, freshwater, ephemeral wetlands. It has not been documented on any of the Forests included in this BA, but is suspected to occur based on the presence of habitat on the Gifford Pinchot, Okanogan-Wenatchee, and Wallowa-Whitman NFs. It this species was present, it could be adversely affected by alternation of hydrological conditions associated with removal or replacement of culverts. Proposed fish passage improvement projects located in the vicinity of suitable habitat may affect, but are not likely to adversely affect this species with the implementation of the design criteria described below.

h. **Wenatchee Mountains Checker-Mallow** (*Sidalcea oregana var. calv)* – The Wenatchee Mountains checker-mallow has a limited range and is know only to occur at six sites in mid-elevation wetlands and moist meadows of the Wenatchee Mountains in central Washington. The only Forest included in this BA where the species has been documented and designated critical habitat occurs is the Okanogan-Wenatchee NF. Potential effects to this species could occur if project activities altered the hydrology of habitat where it occurs, or affected primary constituent elements of critical habitat. However, with implementation of the project design criteria described below, the proposed fish passage improvement projects may affect, but are not likely to adversely affect this species.

For **threatened or endangered plant species** that may occur in project areas within the scope of this Biological Assessment, the following criteria will be applied:

PL1: If, after pre-field review, the botanist determines that a known site of a listed plant is within 0.25-mile of the project action area or that suitable or potential habitat may be affect by project activities, the project site will be evaluated through a site visit and vegetation survey conducted by a botanist. This visit and survey will be conducted at the appropriate time of year to identify the species and determine whether individual listed plants or potential habitat are present, and may be adversely affected by project activities.

PL2: If one or more listed species are present and may be affected by the project, the project is not covered by this Biological Assessment and consultation with the U.S. Fish and Wildlife Service under Section 7 of the ESA must be initiated.

PL3: Due to soil disturbance that will occur, and use of heavy equipment that could carry seeds and plant parts into project areas, all appropriate measures will be incorporated into contract or equipment rental agreements to avoid introduction of invasive plants and noxious weeds into project areas.

D. Summary Effects

1. Direct Effects that occur during project implementation

- Occaisional mortality and injury to individual fish (primarily juveniles) due to collection and relocation
- Mortality to individual fish (primarily juveniles) that may not have been removed prior to construction
- Short-term stress to individual fish due to removal or relocation from work area
- Short-term loss of potential habitat to fish in the project vicinity
- Partial or complete blockage of fish passage during constructioin
- Short-term displacement of fish due to turbidity, human/machinery presence, activity, noise, and water quality

2. Indirect Effects that occur after project completion

- Restoration of passage at road crossings for native fish and associated life stages
- Better connectivity between upstream and downstream habitat and watersheds
- Potential for increased genetic diversity of a given species
- Potential for increased diversity of species in upstream areas
- Enhanced passage of bedload and woody debris
- Increase in amount and diversity of habitat for anadromous and migratory forms of fish and aquatic wildlife
- Increased nutrient loading of areas upstream of the fish passage barrier from decay of adult salmonids following spawning
- Restoration of natural bedload size and quantity in road crossing structure
- Restoration of instream physical processes that were interrupted by the barrier.
- Decreased frequency and severity of habitat disturbance due to emergency and routine maintenance of the crossing facility
- Minimal loss of riparian vegetation in the construction area
- Reduced flood damage to road crossing

E. Determinations of Effect to Threatened and Endangered Species

Removal of fish passage barriers covered by this document may affect certain threatened and endangered species and designated critical habitat for those species. All listed threatened and endangered species (and their critical habitat, as appropriate) that may occur within the programmatic area and may be affected by the programmatic activities are addressed in Table 7 – *Summary of Effects Determinations for Fish* and Table 8 – *Summary of Effects Determinations for Wildlife and Plants*.

Table 7 – Summary of Effects Determinations for Fish

SPECIES NAME	STATUS	CRITICAL HABITAT	DETERMINATION OF EFFECT	RATIONALE FOR EFFECT DETERMINATION
Bull Trout (Salvelinus confluentus)	Threatened	No	Likely to Adversely Affect (for species) At the appropriate time, the FWS will assist with amendment of BA to include designated critical habitat.	**Short-term Effects -** Bull trout may be stressed, injured, or killed during fish handling activities prior to de-watering. Fish passage through the work area, which may have occurred on limited basis prior to dewatering, will be blocked during construction. Limited amounts of riparian vegetation will be removed, degrading limited areas of fish habitat. Project related sediment will be carried downstream from the work area for a short period, possibly displacing fish or altering behaviors. Disturbance to listed fish will be minimized by working under conservation measures regarding in-water work periods, fish handling, and sediment/pollution containment. **Long-term Effects -** Beneficial effects include creation of fish passage for all life stages of bull trout, accommodation of natural stream processes at road crossings, and decreased likelihood of road crossing failures.
Lost River Sucker (Deltistes luxatus)	Endangered	No	Not Likely to Adversely Affect (for species and proposed critical habitat)	**Short-term Effects -** Because Lost River suckers are not expected to be in the stream during construction, direct effects to this species are not expected. **Long-term Effects -** Beneficial effects include creation of fish passage for the Lost River Sucker, accommodation of natural stream processes at road crossings, and decreased likelihood of road crossing failures.
Shortnose Sucker (Chasmistes brevirostris)	Endnagered	No	Not Likely to Adversely Affect (for species and proposed critical habitat) *LAA (for species)	**Short-term Effects –** Because Shortnose suckers are not expected to be in the stream during construction, direct effects to this species in most cases are not expected. *However, under certain circumstances, this fish may exhibit stream life history forms and would experience similar effects described under Bull trout. **Long-term Effects -** Beneficial effects include creation of fish passage for the Shortnose Sucker, accommodation of natural stream processes at road crossings, and decreased likelihood of road crossing failures.
Warner Sucker (Catostomus warnerensis)	Threatened	Yes	Not Likely to Adversely Affect (critical habitat)	**Short-term Effects on Species –** Because Warner suckers are not expected to be in the stream during construction, direct effects to this species are not expected. **Long-term Effects on Species –** Beneficial effects include potential creation of fish passage for the Warner Sucker, accommodation of natural stream processes, and decreased likelihood of road crossing failures. **Short-term Effects on Critical Habitat –** Effects associated with sedimentation are expected to be minimal. **Long-term Effects on Critical Habitat –** Effects are expected to be beneficial through restoration of natural stream processes, resulting in improved habitat and a cessation of chronic sedimentation from undersized culverts.

Table 7 – Summary of Effects Determinations for Fish

SPECIES NAME	STATUS	CRITICAL HABITAT	DETERMINATION OF EFFECT	RATIONALE FOR EFFECT DETERMINATION
Lower Columbia River Chinook Salmon (Onchorhynchus tshawytscha)	Threatened	No	Likely to Adversely Affect (for species)	**Short-term Effects –** Chinook salmon may be stressed, injured, or killed during fish handling activities prior to de-watering. Adults are not likely to experience mortality. Fish passage through the work area, which may have occurred on limited basis prior to dewatering, will be blocked during construction. Limited amounts of riparian vegetation will be removed, degrading limited areas of fish habitat. Project related sediment will be carried downstream from the work area for a short period, possibly displacing fish or altering behaviors. Disturbance to listed fish will be minimized by working under conservation measures regarding in-water work periods, fish handling, and sediment/pollution containment. **Long-term Effects -** Beneficial effects include creation of fish passage for all life stages of Chinook salmon, accommodation of natural stream processes at road crossings, and decreased likelihood of road crossing failures.
Upper Columbia River Spring-Run Chinook Salmon (Onchorhynchus tshawytscha)	Endangered	No	Likely to Adversely Affect (for species)	**Short-term Effects –** Chinook salmon may be stressed, injured, or killed during fish handling activities prior to de-watering. Adults are not likely to experience mortality. Fish passage through the work area, which may have occurred on limited basis prior to dewatering, will be blocked during construction. Limited amounts of riparian vegetation will be removed, degrading limited areas of fish habitat. Project related sediment will be carried downstream from the work area for a short period, possibly displacing fish or altering behaviors. Disturbance to listed fish will be minimized by working under conservation measures regarding in-water work periods, fish handling, and sediment/pollution containment. **Long-term Effects -** Beneficial effects include creation of fish passage for all life stages of Chinook salmon, accommodation of natural stream processes at road crossings, and decreased likelihood of road crossing failures.

Table 7 – Summary of Effects Determinations for Fish

SPECIES NAME	STATUS	CRITICAL HABITAT	DETERMINATION OF EFFECT	RATIONALE FOR EFFECT DETERMINATION
Puget Sound Chinook Salmon (Onchorhynchus tshawytscha)	Threatened	No	Likely to Adversely Affect (for species spring/summer-run) Not Likely to Adversely Affect (for species fall-run)	**Short-term Effects (LAA spring/summer-run) –** Chinook salmon may be stressed, injured, or killed during fish handling activities prior to de-watering. Adults are not likely to experience mortality. Fish passage through the work area, which may have occurred on limited basis prior to dewatering, would be blocked during construction. Limited amounts of riparian vegetation will be removed, degrading limited areas of fish habitat. Project related sediment will be carried downstream from the work area for a short period, possibly displacing fish or altering behaviors. Disturbance to listed fish will be minimized by working under conservation measures regarding in-water work periods, fish handling, and sediment and pollution containment. **Short-term Effects (NLAA fall-run) –** Because the Puget Sound Chinook Salmon (fall-run) are not expected to be in the stream during construction, direct effects to this species are not expected. **Long-term Effects (all runs) -** Beneficial effects include creation of fish passage for all life stages of Chinook salmon, accommodation of natural stream processes at road crossings, and decreased likelihood of road crossing failures.
Snake River Fall-Run Chinook Salmon (Onchorhynchus tshawytscha)	Threatened	Yes	Not Likely to Adversely Affect (for species and critical habitat)	**Short-term Effects to Species –**.Because the Snake River Fall-Run Chinook Salmon are not expected to be in the stream during construction, direct effects to this species are not expected. **Long-term Effects to Species –** Beneficial effects include creation of fish passage for all life stages of Chinook salmon, accommodation of natural stream processes at road crossings, and decreased likelihood of road crossing failures. **Short-term Effects to Critical Habitat –** Effects associated with sedimentation are expected to be minimal. **Long-term Effects to Critical Habitat –** Effects are expected to be beneficial through restoration of natural stream processes, resulting in improved habitat and a cessation of chronic sedimentation from undersized culverts.

Table 7 – Summary of Effects Determinations for Fish

SPECIES NAME	STATUS	CRITICAL HABITAT	DETERMINATION OF EFFECT	RATIONALE FOR EFFECT DETERMINATION
Snake River Spring/Summer Run Chinook Salmon (Onchorhynchus tshawytscha)	Threatened	Yes	Likely to Adversely Affect (for species) Not Likely to Adversely Affect (for critical habitat)	**Short-term Effects to Species (LAA) –** Chinook salmon juveniles may be stressed, injured, or killed during fish handling activities prior to de-watering. Adults are not likely to experience mortality. Fish passage through the work area, which may have occurred on limited basis prior to dewatering, will be blocked during construction. Limited amounts of riparian vegetation will be removed, degrading limited areas of fish habitat. Project related sediment will be carried downstream from the work area for a short period, possibly displacing fish or altering behaviors. Disturbance to listed fish will be minimized by working under conservation measures regarding in-water work periods, fish handling, and sediment/pollution containment. **Long-term Effects to Species –** Beneficial effects include creation of fish passage for all life stages of Chinook salmon, accommodation of natural stream processes at road crossings, and decreased likelihood of road crossing failures. **Short-term Effects to Critical Habitat (NLAA) –** Effects associated with sedimentation are expected to be minimal. **Long-term Effects to Critical Habitat –** Effects are expected to be beneficial through restoration of natural stream processes, resulting in improved habitat and a cessation of chronic sedimentation from undersized culverts.
Columbia River Chum Salmon (Onchorhynchus keta)	Threatened	No	Not Likely to Adversely Affect (for species)	**Short-term Effects –** Because Chum salmon are not expected to be in the stream during construction, direct effects are not expected. **Long-term Effects –** Beneficial effects include creation of fish passage for all life stages of Chum salmon, accommodation of natural stream processes at road crossings, and decreased likelihood of road crossing failures.
Hood Canal Summer Run Chum Salmon (Onchorhynchus keta)	Threatened	No	Not Likely to Adversely Affect (for species)	**Short-term Effects –** Because Chum salmon are not expected to be in the stream during construction, direct effects to this species are not expected. **Long-term Effects –** Beneficial effects include creation of fish passage for all life stages of Chum salmon, accommodation of natural stream processes at road crossings, and decreased likelihood of road crossing failures.

Table 7 – Summary of Effects Determinations for Fish

SPECIES NAME	STATUS	CRITICAL HABITAT	DETERMINATION OF EFFECT	RATIONALE FOR EFFECT DETERMINATION
Lower Columbia River Steelhead (Onchorhynchus mykiss)	Threatened	No	Likely to Adversely Affect (for species)	**Short-term Effects –** Steelhead trout may be stressed, injured, or killed during fish handling activities prior to de-watering. Adults are not likely to experience mortality. Fish passage through the work area, which may have occurred on limited basis prior to dewatering, will be blocked during construction. Limited amounts of riparian vegetation will be removed, degrading limited areas of fish habitat. Project related sediment will be carried downstream from the work area for a short period, possibly displacing fish or altering behaviors. Disturbance to listed fish will be minimized by working under conservation measures regarding in-water work periods, fish handling, and sediment/pollution containment. **Long-term Effects –** Beneficial effects include creation of fish passage for all life stages of Steelhead trout, accommodation of natural stream processes at road crossings, and decreased likelihood of road crossing failures.
Middle Columbia River Steelhead (Onchorhynchus mykiss)	Threatened	No	Likely to Adversely Affect (for species)	**Short-term Effects –** Steelhead trout may be stressed, injured, or killed during fish handling activities prior to de-watering. Adults are not likely to experience mortality. Fish passage through the work area, which may have occurred on limited basis prior to dewatering, would be blocked during construction. Limited amounts of riparian vegetation will be removed, degrading limited areas of fish habitat. Project related sediment will be carried downstream from the work area for a short period, possibly displacing fish or altering behaviors. Disturbance to listed fish will be minimized by working under conservation measures regarding in-water work periods, fish handling, and sediment/pollution containment. **Long-term Effects –** Beneficial effects include creation of fish passage for all life stages of Steelhead trout, accommodation of natural stream processes at road crossings, and decreased likelihood of road crossing failures.

Table 7 – Summary of Effects Determinations for Fish

SPECIES NAME	STATUS	CRITICAL HABITAT	DETERMINATION OF EFFECT	RATIONALE FOR EFFECT DETERMINATION
Upper Columbia River Steelhead (Onchorhynchus mykiss)	Endangered	No	Likely to Adversely Affect (for species)	**Short-term Effects –** Steelhead trout may be stressed, injured, or killed during fish handling activities prior to de-watering. Adults are not likely to experience mortality. Fish passage through the work area, which may have occurred on limited basis prior to dewatering, would be blocked during construction. Limited amounts of riparian vegetation will be removed, degrading limited areas of fish habitat. Project related sediment will be carried downstream from the work area for a short period, possibly displacing fish or altering behaviors. Disturbance to listed fish will be minimized by working under conservation measures regarding in-water work periods, fish handling, and sediment/pollution containment. **Long-term Effects –** Beneficial effects include creation of fish passage for all life stages of Steelhead trout, accommodation of natural stream processes at road crossings, and decreased likelihood of road crossing failures.
Snake River Basin Steelhead (Onchorhynchus mykiss)	Threatened	No	Likely to Adversely Affect (for species)	**Short-term Effects –** Steelhead trout may be stressed, injured, or killed during fish handling activities prior to de-watering. Adults are not likely to experience mortality. Fish passage through the work area, which may have occurred on limited basis prior to dewatering, would be blocked during construction. Limited amounts of riparian vegetation will be removed, degrading limited areas of fish habitat. Project related sediment will be carried downstream from the work area for a short period, possibly displacing fish or altering behaviors. Disturbance to listed fish will be minimized by working under conservation measures regarding in-water work periods, fish handling and sediment/pollution containment. **Long-term Effects –** Beneficial effects include creation of fish passage for all life stages of Steelhead trout, accommodation of natural stream processes at road crossings, and decreased likelihood of road crossing failures.

Table 8 - Summary of Effects Determinations for Wildlife and Plants

Species Name	Status	Critical Habitat	Effect Determination
			(See text for rationale)
Birds			
Northern Bald Eagle *Haliaeetus leucocephalus*	T	N	**NLAA**
Marbled murrelet *Brachyramphus marmoratus*	T	Y	**NLAA**
Marbled murrelet *Brachyramphus marmoratus*	T		**LAA**
Northern Spotted Owl *Strix occidentalis*	T	Y	**NLAA**
Northern Spotted Owl *Strix occidentalis*	T		**LAA**
Mammals			
Gray wolf *Canis lupus*	E	N	**NLAA**
Woodland Caribou *Rangifer tarandus caribou*	E	N	**NLAA**
Grizzly Bear *Ursus arctos*	T	N	**NLAA**
Canada lynx *Lynx canadensis*	T	N	**NLAA**
Plants			
Wenatchee Mtns. Checker Mallow *Sidalcea oregana var.calva*	E	Y	**NLAA**
Spalding's Silene *Silene spaldingii*	T	N	**NLAA**
Marsh Sandwort *Arenaria paludicola*	E	N	**NLAA**
Showy Stickseed *Hackelia venusta*	E	N	**NLAA**
Water Howellia *Howellia aquatilis*	T	N	**NLAA**
Mac Farlane's Four O'clock *Mirabilis macfarlanei*	T	N	**NLAA**
Ute's Ladies' -Tresses *Spiranthes diluvialis*	T	N	**NLAA**
Kincaid's Sulphur Lupine *Lupinus sulphureus kincaidii*	T	N	**NLAA**
Howell's Spectacular Thelypody *Thelypodium howellii spectabilis*	T	N	**NLAA**

F. Cumulative Effects

1. Scope

In the context of the Endangered Species Act (ESA), cumulative effects encompass the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the covered area; in this case, the area of Oregon east of the Cascade Mountains and the entire state of Washington. Future Federal actions, including those that are unrelated to the proposed action, are not considered in this section because they require separate consultation pursuant to Section 7 of the ESA.

Cumulative effects, in the context of Section 7 consultation, are generic to the area of consideration and not related to the Federal action. The cumulative effects analysis is therefore independent of the specific culvert removal and replacement activities addressed in this programmatic BA and addresses impacts in the context of general trends in population and land-use.

2. Population Trends

Within the state of Oregon, the population is expected to increase 34 percent over the next 25 years (ODAS 1999). Washington's current population of about 5.8 million people has increased by about 1 million since 1990. Forecasts for population growth predict an additional 1.2 to 2.5 million people residing in Washington by 2020 (OFM 1999).

3. Residential, Commercial, and Infrastructure Development

Intuitively, population growth results in increasing residential and commercial development. Improvements and upgrades to infrastructure (including highways, other transportation facilities, pipelines, power lines, and power plants) will likely track closely with increased residential and commercial development. Primary pathways of potential effects of land development include the following: direct habitat loss, decreased water quality, contamination of waterways and uplands, changes to runoff patterns, habitat fragmentation, isolation of populations, and loss of habitat diversity. In general, as development increases the quantity and quality of habitat suitable for threatened and endangered species typically decreases. Based on past trends and types of development, future residential, commercial, and infrastructure development will likely lead to further habitat degradation. Actions taken to mitigate for the potential impacts of development may help slow the rate of habitat degradation.

4. Agriculture

Assuming future trends mirror the historical pattern in Oregon and Washington, substantial additional impacts to fish and wildlife due to agriculture are not expected. However, in many areas within the programmatic area, certain ongoing agricultural practices (such as irrigation, chemical application, and regular habitat disturbance in agricultural areas) are likely to prevent habitat from reaching properly functioning conditions for listed species.

5. Forestry

In Oregon and Washington, non-federal timber harvest typically involves clear-cutting. Impacts due to clear-cutting and forest roads have been well documented and such impacts are long lasting and additive. Timber harvest and associated impacts are concentrated in western Oregon and Washington; however, timber harvest is anticipated in all of the 50 sub-basins, to varying degrees, within the programmatic area. Although the rate of harvest appears to be slowing in some areas and improved forestry practices have been implemented, the collective impacts of past and reasonably foreseeable future forestry activities are likely to result in additional future degradation of habitat for listed species.

6. **Pollutant Discharge**

   Air and water pollution can degrade habitat and have lethal and sub-lethal effects on fish and wildlife. Increased human population typically causes increased air and water pollution. Developed areas also generate effluent, and runoff is often polluted with a variety of substances. In Oregon, each of the sub-basins within the programmatic area contain 303(d)-listed streams with water temperature being the most frequent parameter exceeding state standards. Other notable parameters include bacteria, dissolved oxygen, flow modification, habitat modification, nutrients, pH, sedimentation, total dissolved gas, toxics and turbidity. In a like manner, nearly 60 percent of the lakes, streams, and estuaries for which there is data fail to meet water quality standards in Washington as of 1999 (DNR 2000)

   Ongoing activities in Oregon and Washington will help mitigate and/or reverse pollutant sinks and sources. The Oregon Department of Environmental Quality (DEQ), for instance, has completed TMDLs for several major basins since 1998. By 2004, DEQ will complete TMDLs in more than 40 additional basins. Even still continued pollutant discharges will likely continue in the future and are very likely to degrade habitat for listed species.

7. **Oregon and Washinton Fish Recovery Efforts**

   a. **Oregon –** Beginning in 1997**,** the State of Oregon developed a comprehensive aquatic conservation strategy (The Oregon Plan). The goal of the Oregon Plan is to "restore populations and fisheries to productive and sustainable levels that will provide substantial environmental, cultural, and economic benefits." Components of this plan include (1) coordination of efforts by local, state, and federal governments as well as tribal, private, and other interests, (2) development of action plans with relevance and ownership at the local level, (3) monitoring progress, and (4) making appropriate corrective changes in the future. This process included chartering 84 locally formed “watershed councils” across the State. Membership on the watershed councils includes landowners, businesses interests, agricultural interests, sport fishers, irrigation/water districts, individuals, State, Federal, and Tribal agencies, and local government officials.

      Further, since 1990, the State of Oregon has taken several actions to address the conservation and recovery of bull trout. More restrictive harvest regulations were implemented beginning in 1990; by 1994 the harvest of bull trout was prohibited throughout the State with the sole exception of Lake Billy Chinook in central Oregon. Bull trout working groups have been established in the Klamath, Deschutes, Hood, Willamette, Odell Lake, Umatilla and Walla Walla, John Day, Malheur, and Pine Creek river basins for the purpose of developing bull trout conservation strategies. In addition, the Oregon Department of Fish and Wildlife reduced the stocking of hatchery-reared rainbow trout and brook trout in areas where bull trout occur, and genetic analysis for most bull trout populations was completed in 1997.

b. Washington – Washington State has developed a salmon restoration strategy to help recover dwindling fish stocks. A draft Statewide Strategy to Recover Salmon, "Extinction is not an Option," was produced by the Washington Governor's Salmon Recovery Office (Washington Governor's Salmon Recovery Office 1999) and Joint Natural Resources Cabinet. The plan describes how State agencies and local governments will work together to address habitat, harvest, hatcheries, and hydropower as they relate to recovery of listed species. While the Washington Governor's plan focuses primarily on salmon, many of the same factors affecting salmon also impact bull trout.

The Washington State legislature created the Salmon Recovery Act (ESHB 2496) and Watershed Management Act (ESHB 2514) to assist in salmon recovery efforts. The Watershed Management Act provided funding and a planning framework for locally based watershed management groups to address water quality and quantity. The Salmon Recovery Act provides direction for the development of limiting factors analyses on salmon habitat and creates a list of prioritized restoration projects. While not specifically targeting limiting factors for bull trout, these documents have played an important role in the development of bull trout recovery unit chapters.

To further enhance bull trout populations, the Washington Department of Fish and Wildlife no longer stocks brook trout in streams or lakes connected to bull trout waters. Fishing regulations prohibit harvest of bull trout, except for a few areas where stocks are considered "healthy." The Washington Department of Fish and Wildlife is also currently involved in a mapping effort to update bull trout distribution data within the State of Washington, including all known occurrences, spawning and rearing areas, and potential habitats. Likewise, the salmon and steelhead inventory and assessment program is currently updating their database to include the entire State, which consists of an inventory of stream reaches and associated habitat parameters important for the recovery of salmonid species and bull trout.

8. Conclusion

The ESA listings of fish and wildlife species in the States of Oregon and Washington have been based, in part, on the additive impacts of growth, development, and other human activities. At this point, the trends discussed above indicate that future impacts will progress similarly, leading to additional adverse impacts on all fish and wildlife and their habitats. Changes to past development practices and fish recovery efforts in Oregon and Washington provide hope that past trends are not predictive of future circumstances.

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VII. Appendix 1

A. Oregon's Allowable In-water Work Windows (ODFW)

Table 9 – Oregon's Allowable In-Water Work Windows

Watershed District Office	*Stream and All Tributaries*	*Activity Is Allowed Only Between These Dates*
Deschutes Watershed District		
The Dalles Office - (541) 296-4628	DESCHUTES RIVER (BELOW PELTON DAM)	February 1 - March 15 *(CHF,STS,RB)*
	White River	July 1 - October 31 *(RB)*
	Buckhollow Cr.	July 1 - October 31 *(STS,RB)*
	Bakeoven Cr.	July 1 - October 31 *(STS,RB)*
	Trout Cr.	July 1 - October 31 *(STS,RB)*
Bend Office - (541) 388-6363	METOLIUS RIVER	by specific arrangement *(K,RB,BR,BUT)*
	Spring Creek	July 1 - September 30 *(K,RB)*
	Lake Creek	July 1 - September 30 *(K,RB,BR)*
	DESCHUTES RIVER (Lake Billy Chinook to Bend)	July 1 - September 30 *(RB,BR,BUT,K)*
	Squaw Creek	July 1 - September 30 *(RB,BR,BUT,K)*
	Tumalo	July 1 - October 15 *(RB,BR,BUT)*
Klamath Watershed District		
Klamath Falls Office - (541) 883-5732	KLAMATH RIVER (above Keno)	July 1 – February 1 *(SNS,BCHUB,RB)*
	Lost River above Bonanza	July 1 – February 1 *(RT,SNS)*
	Lost River below Bonanza	July 1 - March 31 *(RT)*
	Williamson River	August 1 - September 30 *(RB,BT,BR,RT,SNS,LRS,KLS)*
	Sprague River	August 1 - September 30 *(BUT,LRS,SNS,RB,BT,BR)*
	Sycan River	August 1 - September 30 *(RB,BT,BR,BUT,LRS,SNS)*
	Wood River	August 1 - September 30 *(RB,BR,BUT,SNS)*
	WARNER VALLEY TRIBUTARIES	July 1 - September 15 *(WSUC,FD)*

Table 9 – Oregon's Allowable In-Water Work Windows

Watershed District Office	***Stream and All Tributaries***	***Activity Is Allowed Only Between These Dates***
Malheur Watershed District Hines Office - (541) 573-6582	<u>MALHEUR RIVER (Namorf Dam to Drewsey Valley)</u>	November 1 - March 31 *(RT,RB)*
	North Fork Malheur (mouth to Beulah Res.)	November 1 - March 31 *(RT,RB)*
	North Fork Malheur (above Beulah Res.)	July 1 - August 31 *(BUT,RT,BT)*
	South Fork Malheur	October 1 - March 31 *(RT)*
	Malheur River (above Drewsey Valley)	July 1 - August 31 *(BUT,RT,BT)*
<u>John Day Office - (541) 575-1167</u>	<u>LOWER JOHN DAY</u>	
	John Day River (below John Day)	July 15 - August 31 *(STS,RT)*
	Rock Creek (Gilliam Co.)	July 15 - September 30 *(STS,RT)*
	North Fork John Day River (below U.S. 395)	July 15 - August 31 *(STS,RT)*
	Middle Fork John Day River (below US 395)	July 15 - August 31 *(STS,RT)*
	Middle Fork John Day River (above US 395)	July 15 - August 15 *(CHS,STS,RT,BUT)*
	North Fork John Day River (above U.S. 395)	July 15 - August 15 *(CHS,STS,BUT)*
	<u>UPPER JOHN DAY</u>	
	South Fork John Day River	July 15 - August 31 *(STS,RT)*
	John Day River (above John Day)	July 15 - August 15 *(CHS,STS,BUT,RT,CT)*
	Canyon Creek	July 15 - August 31 *(STS,RB,CT)*

Table 9 – Oregon's Allowable In-Water Work Windows

Watershed District Office	***Stream and All Tributaries***	***Activity Is Allowed Only Between These Dates***
John Day Office - (541) 575-1167	LOWER JOHN DAY	
	John Day River (below John Day)	July 15 - August 31 *(STS,RT)*
	Rock Creek (Gilliam Co.)	July 15 - September 30 *(STS,RT)*
	North Fork John Day River (below U.S. 395)	July 15 - August 31 *(STS,RT)*
	Middle Fork John Day River (below US 395)	July 15 - August 31 *(STS,RT)*
	Middle Fork John Day River (above US 395)	July 15 - August 15 *(CHS,STS,RT,BUT)*
	North Fork John Day River (above U.S. 395	July 15 - August 15 *(CHS,STS,BUT)*
	UPPER JOHN DAY	
	South Fork John Day River	July 15 - August 31 *(STS,RT0*
	John Day River (above John Day)	July 15 - August 15 *(CHS,STS,BUT,RT,CT)*
	Canyon Creek	July 15 - August 31 *(STS,RB,CT)*
Pendleton Office - (541) 276-2344	UMATILLA	
	Umatilla River (below Pendleton)	July 15 - October 15 *(CHF,CHS,CO,STS)*
	Butter Creek	July 1 - December 31 *(RT)*
	Umatilla River (above Pendleton)	July 1 - August 15 *(CHS,CHF,STS,RT)*
	Birch Creek	July 1 - October 31 *(STS,RT)*
	McKay Creek (below reservoir)	November 1 - March 31 *(CHF,CHS,CO,STS)*
	McKay Creek (above reservoir)	July 1 - December 31 *(RT)*
	Wildhorse Creek	July 1 - October 31 *(CHF,CHS,CO,STS,RT)*
	Meacham Creek	July 1 - August 15 *(CHS,STS,RT,BUT)*
	WALLA WALLA	
	Walla Walla River (below Harris Park)	July 1 - October 31 *(STS,RT,BUT)*
	Mill Creek	July 1 - October 31 *(STS,RT,BUT)*
	Walla Walla River (above Harris Park	July 1 - August 15 *(STS,RT,BUT)*

Table 9 – Oregon's Allowable In-Water Work Windows		
Watershed District Office	***Stream and Tributaries***	***Activity Is Allowed Only Between These Dates***
Grande Ronde Watershed District		
Enterprise Office - (541) 426-3279	GRANDE RONDE	
	Grande Ronde River (below Wallowa River)	July 1 - September 15 *(CHF,STS)*
	Wenaha River	July 1 - August 15 *(CHS,STS,BUT)*
	Joseph Creek	July 1 - March 31 *(STS*)*
	Wallowa River	July 15 - August 15 *(CHS,STS,RB,BT,BUT)*
	Imnaha River (above Big Sheep Creek)	July 15 - August 15 *(CHS,STS,BUT)*
	Imnaha River (below Big Sheep Creek)	July 1 – October 15 *(CHF,STS)*
La Grande Office - (541) 963-2138	GRANDE RONDE	
	Grande Ronde River (Wallowa River to Highway 244 Bridge)	July 1 - October 15 *(CHS,STS,RB,BUT)*
	Minam River	July 1 – August 15 *(CHS,STS,RB,BUT)*
	Lookingglass Creek	July 1 - August 15 *(CHS,STS,RB,BUT)*
	Catherine Creek (to, and including Little Creek)	July 1 - October 15 *(CHS,STS,RB,BUT)*
	Catherine Creek (above Little Creek)	July 1 – August 15 *(CHS,STS,RB,BUT)*
	Grande Ronde River (above highway 244 bridge)	July 1 - July 31 *(CHS,STS,RB,BUT)*
	SNAKE RIVER (Reservoir Tributaries)	July 1 - October 31 *(RB)*
	Burnt River	July 1 - October 31 *(RB,BT)*
	Pine Creek	July 1 – August 31 *(RB,BUT)*
	Powder River (mouth to Phillips Reservoir)	July 1 - October 31 *(RB)*
	POWDER RIVER (mouth to Phillips Reservoir tributaries)	
	Anthony Creek	July 1 – August 31 *(RB,BUT)*
	North Powder R. (above Dutch Flat Cr.)	July 1 – August 31 *(RB,BUT)*
	Wolf Creek (above Wolf Creek Res.)	July 1 – August 31 *(RB,BUT0*
	Big Muddy Creek (above Foothill Rd.)	July 1 – August 31 *(RB,BUT)*
	Pine Creek (above North Fork Pine Cr.)	July 1 – August 31 *(RB,BUT)*
	Salmon Creek (above Pocahontas Road)	July 1 – August 31 *(RB,BUT)*
	POWDER RIVER (above Phillips Res)	July 1 – August 31 *(RB,BUT)*
	Deer Creek	July 1 – August 31 *(RB,BUT)*

Oregon Department of Fish and Wildlife Fish Codes	
AC - Alford chub	JUV - juvenile salmonids
BCHUB – blue chub	K - kokanee
BR - brown trout	KLS – Klamath largescale sucker
BT - brook trout	LCT - Lahontan cutthroat trout
BUT - bull trout	LRS – Lost River sucker
CR - Crappie	MAR - various marine species of fish
CHF - chinook salmon, fall	MD – Millicoma Dace
CHR - chinook salmon, summer	MMS - Malheur mottled sculpin
CHS - chinook salmon, spring	PRCH - pit roach
CO - coho salmon	PSCL - pit sculpin
CS - chum salmon	RB - rainbow trout
CT - cutthroat trout (includes sea run)	RT - red band trout
CTC - Catlow tui chub	SHL - various marine shell fish
GCB - goose lake chub	SNS shortnose sucker
GLAM - goose lake lamprey	SS - sockeye salmon
GSUC - goose lake sucker	STS - steelhead summer
JCRT – Jenny Creek red band trout	STW - steelhead winter
JCS – Jenny Creek sucker	WW - various warm water game fish

B. Washington's Allowable In-water Work Windows (WDFW)

Table 10 – Washington's Allowable In-Water Work Windows

General Season [1] by County		*Exceptions to General Season [2]*	
County / Watershed	***Activity Is Allowed Only Between These Dates***	***Stream and All Tributaries, Unless Otherwise Listed [2]***	***Activity Is Allowed Only Between These Dates***
Adams County	July 1- October 31	Esquatzel Creek (36.MISC) Palouse River (34.0003)	July 1 - September 30 June 15 - October 15
Asotin County	July 15 - September 30	Asotin Creek (35.1716) - mouth to Charlie Creek (35.1908) - above Charlie Creek (35.1908) Grande Ronde River (35.2192)	 July 15 - September 30 July 15 - August 31 July 15 - August 31
Benton County	June 1 - September 30	Yakima River (37.0002)	July 1 - September 30
Chelan County	July 1 - August 15	Chelan River (47.0052) - mouth to Chelan Gorge Colockum Creek (40.0760) Entiat River (46.0042) - below McKenzie Irrigation Dam - Mad River (46.0125) Entiat River (46.0042) - above McKenzie Irrigation Dam Lake Chelan tributaries Little Wenatchee River (45.0985) - White River (45.1116) Squilchuck Creek (40.0836) Stemilt Creek (40.0808) - mouth to falls Wenatchee River (45.0030) - mouth to Chiwaukum Creek - Icicle Creek (45.0474) - Peshastin Creek (45.0232) - mouth to Negro Creek (45.0323) - Peshastin Creek (45.0232) - above Negro Creek (45.0323) Wenatchee River (45.0030) -Chiwaukum Creek to Wenatchee Lake - Beaver Creek (45.0751) - Chiwaukum Creek (45. 0700)	July 1 - September 30 July 1 - October 31 July 1 - September 30 July 1 - August 15 July 1 - August 1 July 1 - August 15 July 1 - August 1 July 1 - August 1 July 1 - October 31 July 1 - October 31 July 1 - September 30 July 1 - August 1 July 1 - August 15 July 1 - October 31 July 1 - August 1 July 1 - September 30 July 1 - August 1

Table 10 – Washington's Allowable In-Water Work Windows

General Season [1] by County		Exceptions to General Season [2]	
County / Watershed	**Activity Is Allowed Only Between These Dates**	**Stream and All Tributaries, Unless Otherwise Listed [2]**	**Activity Is Allowed Only Between These Dates**
Clallam County	July 15 - September 30	Bogachiel River (20.0162)	July 15 - August 15
		Calawah River (20.0175)	July 15 - August 15
		Clallum River (19.0129)	July 15 - September 15
		Dungeness River (18.0018)	July 15 - August 15
		Elwha River (18.0272) - mouth to lower dam	July 1 - August 15
		Hoko River (19.0148)	July 15 - September 15
		Jimmycomelately Creek (17.0285)	July 1 - August 31
		Lyre River (19.0031)	July 15 - September 15
		McDonald Creek (18.0160)	July 1 - August 15
		Morse Creek (18.0185)	July 1 - August 15
		Pysht River (19.0113)	July 15 - September 15
		Sekiu River (19.0203)	July 15 - September 15
		Sol Duc River (20.0096)	July 15 - August 15
		Sooes River (20.0015)	July 15 - September 15
		Lake Ozette tributaries	July 15 - September 30
		Lake Pleasant tributaries	July 15 - September 30
Clark County	July 1 - September 30	Lewis River (27.0168) - mouth to East Fork Lewis River	June 1 - October 31
		- East Fork Lewis River (27.0173) - mouth to Sunset Falls	July 15 - September 30
		- Copper Creek (27.0275)	July 15 - October 31
		- East Fork Lewis River (27.0173)-above Sunset Falls	July 15 - October 31
		- North Fork Lewis River (27.0168) - confluence with East Fork Lewis River to Merwin Dam	August 1 - August 31
		- Cedar Creek (27.0339)	August 1 - September 30
		- North Fork Lewis River (27.0168) - Merwin Dam to Lower Falls	July 1 - July 31
		Lake River (28.0020)	July 1 - September 30
		Washougal River (28.0159)	August 1 - August 31
Columbia County	July 15 - September 30	Tucannon River (35.0009) - mouth to Marengo bridge	July 15 - September 15
		Tucannon River (35.0009) - Marengo bridge to Tumalum Creek (35.0368)	July 15 - August 31
		Tucannon River (35.0009) - above Tumalum Creek (35.0368)	July 15 - August 15
		Touchet River (32.0097) - mouth to Forks	July 15 - September 30
		- North Fork Touchet River (32.0761)	July 15 - August 20
		- South Fork Touchet River (32.0708)	
		- mouth to Griffen Fork (32.0739)	July 15 - September 30
		- above Griffen Fork (32.0739)	July 15 - August 20

Table 10 – Washington's Allowable In-Water Work Windows

General Season [1] by County		Exceptions to General Season [2]	
County / Watershed	**Activity Is Allowed Only Between These Dates**	**Stream and All Tributaries, Unless Otherwise Listed [2]**	**Activity Is Allowed Only Between These Dates**
Cowlitz County	July 1 - September 30	Cowlitz River (26.0002)	August 1 - August 31
		- Coweeman River (26.0003)	August 1 - September 30
		- Toutle River (26.0227)	July 1 - September 15
		Kalama River (27.0002)	August 1 - August 31
		Lewis River (27.0168) - mouth to East Fork Lewis River	June 1 - October 31
		- North Fork Lewis River (27.0168) - confluence with East Fork Lewis River to Merwin Dam	August 1 - August 31
		- North Fork Lewis River (27.0168) - Merwin Dam to Lower Falls	July 1 - July 31
		- North Fork Lewis River (27.0168) - above Lower Falls	July 1 - October 31
Douglas County	July 1 - September 30	No Exceptions	
Ferry County	July 1 - August 31	No Exceptions	
Franklin County	June 1 - September 30	Palouse River (34.0003) - above falls	June 15 - October 15
Garfield County	July 15 - September 30	Asotin Creek (35.1716)	July 15 - August 15
		Tucannon River (35.0009)	July 15 - August 15
Grant County	July 1 - October 31	No Exceptions	
Grays Harbor County	July 15 - October 15	Chehalis River (22.0190/23.0190) - mouth to Porter Creek	June 1 - October 15
		- Cloquallum River (22.0501)	July 15 - September 30
		- Satsop River (22.0360)	July 15 - August 31
		Chehalis River (22.0190/23.0190) - above Porter Creek	July 15 - September 30
		- Cedar Creek (23.0570)	July 15 - September 30
		- Porter Creek (23.0543)	July 15 - September 30
		Elk River (22.1333)	July 15 - September 30
		Johns River (22.1270)	July 15 - September 30
		North River (24.0034)	July 15 - September 15
		Quinault River (21.0398)	July 15 - August 31
Island County	June 15 - October 15	No Exceptions	

Table 10 – Washington's Allowable In-Water Work Windows

General Season [1] by County		***Exceptions to General Season [2]***	
County / Watershed	***Activity Is Allowed Only Between These Dates***	***Stream and All Tributaries, Unless Otherwise Listed [2]***	***Activity Is Allowed Only Between These Dates***
Jefferson County	July 15 - October 31	Big Quilcene River (17.0012)	July 15 - August 31
		Bogachiel River (20.0162)	July 15 - August 15
		Chimacum Creek (17.0203)	July 15 - August 31
		Donovan Creek (17.0115)	July 15 - September 30
		Dosewallips River (16.0442)	July 15 - August 31
		Duckabush River (16.0351)	July 15 - August 31
		Dungeness River tributaries (18.0018)	July 15 - August 15
		Hoh River (20.0422)	July 15 - August 15
		Little Quilcene River (17.0076)	July 15 - August 31
		Queets River (21.0001)	July 15 - September 15
		Quinault River (21.0398)	July 15 - August 15
		Salmon Creek (17.0245)	July 15 - August 15
		Snow Creek (17.0219)	July 15 - August 15

Table 10 – Washington's Allowable In-Water Work Windows			
General Season [1] by County		*Exceptions to General Season [2]*	
County / Watershed	***Activity Is Allowed Only Between These Dates***	***Stream and All Tributaries, Unless Otherwise Listed [2]***	***Activity Is Allowed Only Between These Dates***
King County	July 1 - September 30	Green River (Duwamish River) (09.0001)	August 1 - August 15
		- Green River (Duwamish River) (09.0001) tributaries	July 15 - September 15
		Lake Washington (08.LKWA) tributaries, including Cedar and Sammamish Rivers	July 1 - August 31
		- Issaquah Creek (08.0178)	June 15 - July 31
		Snoqualmie River (07.0219) - mouth to Snoqualmie Falls	July 1 - September 15
		- Raging River (07.0384)	August 1 -September 15
		- Patterson Creek (07.0376)	June 15 - September 30
		Snoqualmie River (07.0219) - Snoqualmie Falls to mouth of South Fork Snoqualmie River	June 15 - October 31
		- North Fork Snoqualmie River (07.0527)	July 15 - October 31
		- Middle Fork Snoqualmie River (07.0219)	July 15 - October 31
		- South Fork Snoqualmie River (07.0467)	July 15 - October 31
		South Fork Skykomish River (07.0012) - mouth to Sunset Falls	July 1 - August 31
		South Fork Skykomish River (07.0012) - Sunset Falls to Alpine Falls	July 1 - August 31
		South Fork Skykomish River (07.0012) - above Alpine Falls	July 15 - October 31
		- Beckler River (07.1413) - mouth to Boulder Creek	July 15 - August 15
		- Foss River (07.1562) - mouth to forks	July 15 - September 15
		- East Fork Foss River (07.1562)	July 15 - September 30
		- West Fork Foss River (07.1573)	July 15 - August 31
		- Miller River (07.1329) - mouth to forks	July 1 - September 15
		- Miller River (07.1329) - above forks	July 1 - October 31
		Tolt River (07.0291) - mouth to forks	July 15 - October 31
		- North Fork Tolt River (07.0291) - mouth to Yellow Creek	July 15 - September 15
		- North Fork Tolt River (07.0291) - above Yellow Creek	July 15 - October 31
		- South Fork Tolt River (07.0302) - mouth to dam	July 15 - September 15
		- South Fork Tolt River (07.0302) - above dam	July 15 - October 31
		White River (10.0031)	July 15 - August 31
		- Greenwater River (10.0122)	July 15 - August 15

Table 10 – Washington's Allowable In-Water Work Windows

General Season [1] by County		Exceptions to General Season [2]	
County / Watershed	***Activity Is Allowed Only Between These Dates***	***Stream and All Tributaries, Unless Otherwise Listed [2]***	***Activity Is Allowed Only Between These Dates***
Kittitas County	June 1 - September 30	Colockum Creek (40.0760)	July 1 - October 31
		Yakima River (39.0002) - Roza Dam to Teanaway River	July 1 - August 31
		- Teanaway River (39.1236)	August 1 - August 31
		Yakima River (39.0002) - above Teanaway River	August 1 - August 31
		- Kachess River (39.1739) - above Lake Kachess	July 1 - July 31
		- Box Canyon Creek (Lake Kachess) (39.1765)	July 1 - July 31
		- Lake Keechelus (excluding tributaries)	
		- Gold Creek (Lake Keechelus) (39.1842)	July 1 - July 31
		- Little Naches River (38.0852)	July 15 - August 15
		- Wenas Creek (39.0032)	July 15 - October 31
		- Other Yakima River tributaries	July 15 - August 31
Kitsap County	July 15 - October 15	Anderson Creek (15.0211)	June 15 - September 30
		Barker Creek (15.0255)	June 30 - September 15
		Big Beef Creek (15.0389)	June 15 - August 31
		Big Scandia Creek (15.0280)	June 15 - September 30
		Blackjack Creek (15.0203)	June 30 - September 15
		Burley Creek (15.0056)	June 30 - September 15
		Chico Creek (15.0229)	June 30 - September 15
		Clear Creek (15.0249)	June 30 - September 15
		Curley Creek (15.0185)	June 30 - September 15
		Dewatto River (15.0420)	July 15 - August 31
		Dogfish Creek (15.0285)	June 30 - September 15
		Gorst Creek (15.0216)	July 15 - August 31
		Grovers Creek (15.0299)	June 30 - September 15
		Johnson Creek (15.0387)	June 15 - September 30
		Ollala Creek (15.0107)	June 30 - September 15
		Ross Creek (15.0209)	June 15 - September 30
		Salmonberry Creek (15.0188)	June 15 - September 30
		Seabeck Creek (15.0400)	July 15 - August 31
		Steele Creek (15.0273)	June 30 - September 15
Klickitat County	June 15 - September 30	Klickitat River (30.0002) - mouth to Klickitat hatchery	July 1 - August 15
		Klickitat River (30.0002) - above Klickitat hatchery	July 1 - July 31
		White Salmon River (29.0160)	July 1- August 15

Table 10 – Washington's Allowable In-Water Work Windows

General Season[1] by County		Exceptions to General Season[2]	
County / Watershed	***Activity Is Allowed Only Between These Dates***	***Stream and All Tributaries, Unless Otherwise Listed[2]***	***Activity Is Allowed Only Between These Dates***
Lewis County	July 1 - September 30	Chehalis River (22.0190/23.0190) - upstream of South Fork Chehalis River confluence	July 1 - August 31
		- Newaukum River (23.0882)	July 1 - August 31
		- Skookumchuck River (23.0761)	July 1 - August 31
		Cowlitz River (26.0002)	August 1 - August 31
		- Cispus River (26.0668) - mouth to Walupt Creek (26.1010)	August 1 - August 31
		- Yellowjacket Creek (26.0757)	August 1 - August 15
		- McCoy Creek (26.0766) - mouth to lower falls	August 1 - August 15
		- McCoy Creek (26.0766) - above lower falls	August 1 - October 31
		- Cispus River (26.0668) - above Walupt Creek	August 15 - September 30
		- Walupt Creek (26.1010)	August 15 - September 30
		- Tilton River (26.0560)	August 1 - September 30
		- Packwood Lake tributaries	August 15 - September 30
		Nisqually River (11.0008) - above Alder Lake	July 15 - September 30
		Toutle River (26.0227)	July 1 - September 15
Lincoln County	June 15 - October 15	No Exceptions	
Mason County	July 15 - October 31	Cloquallum Creek (22.0501)	July 15 - September 30
		Coulter Creek (15.0002)	July 15 - September 15
		Dewatto River (15.0420)	July 15 - August 31
		Hamma Hamma River (16.0251) - mouth to falls	July 15 - August 31
		- John Creek (16.0253)	July 15 - August 31
		Johns Creek (14.0049)	July 15 - August 31
		Lilliwaup River (16.0230) - below falls	July 15 - August 31
		Lilliwaup River (16.0230) - above falls	July 1 - October 31
		Mill Creek (14.0029)	July 15 - October 15
		Satsop River (22.0360)	July 15 - August 31
		Schaerer Creek (16.0326)	July 15 - August 31
		Sherwood Creek (14.0094)	July 15 - September 15
		Skokomish River (16.0001)	July 15 - September 15
		Tahuya River (15.0446)	July 15 - September 15
		Twanoh Creek (14.0134)	June 15- October 31
		Union River (15.0503)	June 15- August 15

Table 10 – Washington's Allowable In-Water Work Windows

General Season [1] by County		***Exceptions to General Season [2]***	
County / Watershed	***Activity Is Allowed Only Between These Dates***	***Stream and All Tributaries, Unless Otherwise Listed [2]***	***Activity Is Allowed Only Between These Dates***
Okanogan County	July 1 - August 15	Aneas Creek (49.0243) - mouth to falls	July 1 - October 31
		Chewiliken Creek (49.0232) - mouth to falls	July 1 - October 31
		Chiliwist Creek (49.0034) - mouth to falls	July 1 - October 31
		Methow River (48.0007) - mouth to Carleton	July 1 - September 30
		Mosquito Creek (49.0321)	July 1 - October 31
		Nine Mile Creek (49.0516)	July 1 - October 31
		Omak Creek (49.0138) - mouth to falls	August 1 - October 31
		Similkameen River (49.0325) - mainstem	July 1 - September 30
		- Similkameen River (49.0325) tributaries	July 1 - August 15
		Tunk Creek (49.0211) - mouth to falls	July 1 - October 31
Pacific County	July 15 - September 30	Chehalis River (22.0190/23.0190)	July 1 - August 31
		Chinook River (24.MISC)	August 1 - August 31
		Grays River (25.0093)	August 1 - September 30
		Naselle River (24.0543)	July 1 - August 31
		North River (24.0034)	July 15 - September 15
Pend Oreille County	July 1 - August 31	Big Muddy Creek (62.0279)	June 1 - August 31
		Bracket Creek (62.0815)	June 1 - August 31
		Calispel Creek (62.0628) - mouth to Calispel Lake	June 1 - August 31
		Exposure Creek (62.0261)	June 1 - August 31
		Kent Creek (62.0819)	June 1 - August 31
		Lime Creek (62.0014)	June 1 - August 31
		Little Spokane River (55.0003)	June 15 - August 31
		Lodge Creek (62.0859)	June 1 - August 31
		Marshall Creek (62.0842)	June 1 - August 31
		Renshaw Creek (62.0310)	June 1 - August 31

Table 10 – Washington's Allowable In-Water Work Windows

General Season [1] by County		Exceptions to General Season [2]	
County / Watershed	**Activity Is Allowed Only Between These Dates**	**Stream and All Tributaries, Unless Otherwise Listed [2]**	**Activity Is Allowed Only Between These Dates**
Pierce County	July 15 - August 31	Nisqually River (11.0008) - mouth to Alder Lake	July 1 - August 31
		- tributaries below Alder Lake	July 1 - September 15
		Nisqually River (11.0008) - above Alder Lake and tributaries	July 15 - September 15
		Carbon River (10.0413)	July 15 - August 31
		- South Prairie Creek (10.0429) - mouth to Dam at RM 15.7	July 15 - August 31
		- South Prairie Creek (10.0429) - above Dam at RM 15.7	July 1 - October 31
		- Wilkeson Creek (10.0432) - mouth to falls at RM 6.2	July 1 - August 31
		- Wilkeson Creek (10.0432) - above falls at RM 6.2	July 1 - October 31
		- Voight Creek (10.0414) - mouth to falls	July 15 - August 31
		- Voight Creek (10.0414) - above falls	July 15 - October 31
		Rocky Creek (15.0015)	July 15 - August 31
		White River (10.0031)	July 15 - August 31
		- Clearwater River (10.0080)	July 15 - August 15
		- Greenwater River (10.0122)	July 15 - August 15
		- Huckleberry Creek (10.0253)	July 15 - August 15
San Juan County	June 15 - October 15	No Exceptions	
Skagit County	July 1 - September 30	Baker River (04.0435) - mouth to dam	June 15 - August 31
		Samish River (03.0005)	July 15 - September 15
		Skagit River (03.0176/04.0176) - mouth to Sauk River (04.0673)	June 15 - August 31
		Skagit River (03.0176/04.0176) - Sauk River to Gorge Dam	August 1 - August 15
		- Cascade River (04.1411)	July 15 - August 15
		- Illabot Creek (04.1346)	July 15 - August 31
		- Sauk River (04.0673)	August 1 - August 15
		- Suiattle River (04.0710)	July 15 - July 31
		Skagit River (03.0176/04.0176) - above Gorge Dam	August 1 - August 31
		Nooksack River (01.0120)	June 15 - August 15
		- South Fork Nooksack River (01.0246)	July 15 - August 15

Table 10 – Washington's Allowable In-Water Work Windows			
General Season [1] by County		*Exceptions to General Season [2]*	
County / Watershed	***Activity Is Allowed Only Between These Dates***	***Stream and All Tributaries, Unless Otherwise Listed [2]***	***Activity Is Allowed Only Between These Dates***
Skamania County	July 1 - September 30	Cispus River (26.0668)	
		- mouth to Walupt Creek (26.1010)	August 1 - August 31
		- Yellowjacket Creek (26.0757)	August 1 - August 15
		- McCoy Creek (26.0766) - mouth to lower falls	August 1 - August 15
		- McCoy Creek (26.0766) - above lower falls	August 1 - October 31
		East Fork Lewis River (27.0173) - below Sunset Falls	July 15 - September 30
		- Copper Creek (27.0275)	July 15 - October 31
		East Fork Lewis River (27.0173) - above Sunset Falls	July 15 - October 31
		North Fork Lewis River (27.0168) - Merwin Dam to Lower Falls	July 1 - July 31
		North Fork Lewis River (27.0168) - above Lower Falls	July 15 - October 31
		Little White Salmon River (29.0131)	July 1 - August 31
		Washougal River (28.0159)	August 1 - August 31
		White Salmon River (29.0160)	July 1 - August 15
		Wind River (29.0023)	August 1 - August 15

Table 10 – Washington's Allowable In-Water Work Windows

General Season[1] by County		*Exceptions to General Season[2]*	
County / Watershed	***Activity Is Allowed Only Between These Dates***	***Stream and All Tributaries, Unless Otherwise Listed[2]***	***Activity Is Allowed Only Between These Dates***
Snohomish County	July 1 - September 30	All Lake Washington tributaries	July 1 - August 31
		Sauk River (04.0673)	July 15 - August 15
		- Suiattle River	July 15 - August 15
		Snohomish River (07.0012) - mouth to Highway 9	June 1 - October 31
		Snohomish River (07.0012) - above Highway 9	July 1 - August 31
		- Pilchuck River (07.0125) - mouth to city of Snohomish diversion dam	July 1 - August 31
		- Pilchuck River (07.0125) - above city of Snohomish diversion dam	July 1 - September 15
		- Skykomish River (07.0012) - mouth to forks	July 15 - August 31
		- North Fork Skykomish River (07.0982) - mouth to Bear Creek Falls	July 15 - August 31
		- Troublesome Creek (07.1085)	July 15 - August 15
		- North Fork Skykomish River (07.0982) - Bear Creek Falls to Deer Falls	July 15 - August 15
		- North Fork Skykomish River (07.0982) - above Deer Falls	July 15 - October 31
		- Salmon Creek (07.1031)	July 15 - September 30
		- South Fork Skykomish River (07.0012) - mouth to Sunset Falls	July 1 - August 31
		- South Fork Skykomish River (07.0012) - Sunset Falls to Tye River (07.0012)	July 1 - August 31
		- Tye River (07.0012) - mouth to Alpine Falls	July 15 - August 31
		- Tye River (07.0012) - above Alpine Falls	July 15 - October 31
		- Beckler River (07.1413) - mouth to Boulder Creek	July 15 - August 31
		- Beckler River (07.1413) - above Boulder Creek	July 15 - October 31
		- Rapid River (07.1461) - mouth to Meadow Creek	July 15 - September 15
		- Rapid River (07.14610 - above Meadow Creek	July 15 - October 31
		- Sultan River (07.0881) - mouth to old diversion dam	July 15 - August 31
		- Sultan River (07.0881) - old diversion dam to Culmback Dam	July 1 - October 31
		- tributaries above Culmback Dam	August 1 - October 31
		- Wallace River (07.0940) - mouth to Wallace Falls	July 1 - September 1
		- Olney Creek (07.0946) - mouth to Olney Falls	July 1 - September 15
		- Olney Creek (07.0946) - above Olney Falls	July 1- October 31
		- Wallace River (07.0940) above Wallace Falls	July 1 - October 31
		- Snoqualmie River (07.0219)	July 1- August 31
		- all other Snohomish River tributuaries	July 1 - August 31
		Stillaguamish River (05.0001) - mouth to forks	July 1 - August 31
		- South Fork Stillaguamish River (05.0001)	July 15 - August 15
		- North Fork Stillaguamish River (05.0135) - mouth to falls	July 15 - August 15

Table 10 – Washington's Allowable In-Water Work Windows

General Season [1] by County		Exceptions to General Season [2]	
County / Watershed	**Activity Is Allowed Only Between These Dates**	**Stream and All Tributaries, Unless Otherwise Listed [2]**	**Activity Is Allowed Only Between These Dates**
Spokane County	June 15 - August 31	Latah Creek (56.0003) - mainstem	June 15 - October 31
		- tributaries	June 15 - August 31
Stevens County	July 1 - August 31	Big Sheep Creek (61.0150)	July 1 - August 31
Thurston County	July 15 - September 15	Cedar Creek (23.0570)	July 15 - September 30
		Little Deschutes River (13.0110)	July 15 - October 31
		McLane Creek (13.0138)	July 15 - October 31
		Nisqually River (11.0008) - mainstem	July 1 - August 31
		- Nisqually River tributaries	July 1 - September 15
		Porter Creek (23.0543)	July 15 - September 30
		Schneider Creek (14.0009)	July 1 - October 31
		Skookumchuck River (23.0761)	July 1 - August 31
		Woodard Creek (13.0012)	July 1 - October 31
		Woodland Creek (13.0006)	July 1 - October 31
Wahkiakum County	July 15 - September 15	Elochoman River (25.0236)	August 1 - September 30
		Grays River (25.0093)	August 1 - September 30
		Naselle River (24.0543)	July 15 - September 30
Walla Walla County	July 15 - September 30	Mill Creek (32.1436) above Bennington Lake Flood Diversion Dam	July 15 - August 15
		Walla Walla River (32.0008)	July 15 - August 15
Whatcom County	July 1 - September 30	Nooksack River (01.0120) - mouth to Mt Baker Hwy Bridge	June 15 - August 31 in odd years only; June 15 - September 30 in even years only
		Nooksack River (01.0120) - Mt Baker Hwy Bridge to forks	July 1 - August 31 in odd years only; July 1 - September 30 in even years only
		- North Fork Nooksack River (01.0120) - mouth to Nooksack Falls	July 15 - July 31
		- North Fork Nooksack River (01.0120) - above Nooksack Falls	June 15 - September 15
		- Middle Fork Nooksack River (01.0339) - mouth to City of Bellingham diversion dam	July 15 - July 31
		- Middle Fork Nooksack River (01.0339) -above City of Bellingham diversion dam	July 1 - September 15
		- South Fork Nooksack River (01.0246)	July 1 - August 15
		Samish River (03.0005)	July 15 - September 15
		Skagit River (03.0176/04.0176) mouth to Gorge Dam	August 1 - August 15
		- Baker River (04.0435)	July 1 - September 30
		Skagit River (03.0176/04.0176) above Gorge Dam	August 1 - August 31
		- Ross Lake (03.0176/04.0176) tributaries	
		- Canyon Creek (04.2199)	August 1 - August 31
		- Ruby Creek (04.2199)	August 1 - August 31
		- Slate Creek (04.2557) - mouth to Slate Creek Falls	August 1 - August 31
		- Slate Creek (04.2557) - above Slate Creek Falls	July 1 - August 31

Table 10 – Washington's Allowable In-Water Work Windows

General Season [1] by County		Exceptions to General Season [2]	
County / Watershed	***Activity Is Allowed Only Between These Dates***	***Stream and All Tributaries, Unless Otherwise Listed [2]***	***Activity Is Allowed Only Between These Dates***
Whitman County	June 15 - October 15	Alkali Flat Creek (35.0570) Almota Creek (35.1017) Palouse River (34.0003) - mouth to falls Penewawa Creek (35.0916)	July 15 - September 30 July 15 - September 30 June 1 - September 30 July 15 - September 30
Yakima County	June 1 - September 30	Klickitat River (30.0002) Yakima River (37.0002/38.0002/39.0002) - mouth to Roza Dam - Ahtanum Creek (37.1382) - Naches River (38.0003) - mouth to Tieton River - Tieton River (38.0166) - Indian Creek (Rimrock Lake) (38.0302) - Naches River (38.0003) - above confluence of Tieton River - Bumping River (38.0998) - American River (38.1000) - Little Naches River (38.0852) - Rattlesnake Creek (38.0518) - Wenas Creek (39.0032) - other Yakima River tributaries	June 15 - August 1 June 1 - September 15 July 1 - August 15 June 15 - October 31 June 1 - August 15 July 1 - August 15 June 15 - August 15 July 15 - August 15 July 1 - July 15 July 15 - August 15 July 15 - August 15 July 15 - October 31 July 15 - August 31
Columbia River - mouth to Snake River - Snake River to Priest Rapids Dam - above Priest Rapids Dam	 November 1 - February 28 August 1 - August 31 July 1 - February 28	All Columbia River tributaries	See county listings
Snake River	August 1 - August 31	All Snake River tributaries	See county listings

1. The General Season for a county applies to all streams within that county, **unless** a specific season is given for a listed stream in that county under Exceptions to the General Season. Some streams flow through multiple counties. Check the listing for the county in which you propose to work to determine the open season for that stream.

2. The season for a listed Exception to the General Season applies to **all** its tributaries, **unless** a tributary of that stream is also listed with a separate season. Such tributaries are listed below the parent stream with an indent and a (-). Some streams flow through multiple counties. Check the listing for the county in which you propose to work to determine the open season for that stream.